NPG-167

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

ORGANIZATION OF AN OCEANOGRAPHIC DATA BANK
FOR THE PERUVIAN NAVY

by

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September 1981

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Organization of an Oceanographic Data Bank for the Peruvian Navy		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis September 1981
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hector Soldi Soldi		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE September 1981
		13. NUMBER OF PAGES 80
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release, distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

oceanographic data, Peru Current, "El Nino", data exchange, data bank, Peruvian Navy, oceanographic data acquisition, Peru

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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waters near Peru. The data bank will be updated by a long term program of oceanographic data acquisition and exchange with local and foreign institutions. These data will be stored in an easily accessible format that can be useful for the Navy in creating operational products for the fleet and in monitoring and eventually predicting the ocean variability along the coast of Peru.

Some of the applications of the data bank for the Navy, fisheries and other potential users are presented.

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Organization of an Oceanographic Data Bank for the Peruvian Navy

by

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OCEANOGRAPHY

from the

NAVAL POSTGRADUATE SCHOOL
September 1981

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisors, Dr. Roland W. Garwood, and Dr. Douglas McLain, for their assistance, and to the Fleet Numerical Oceanography Center at Monterey for supplying the data for this work.

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I. INTRODUCTION

Oceanographic data have been acquired along the coast of Peru for many decades. The special characteristics of the Peruvian coastal waters, especially the strong upwelling of cold, nutrient rich waters along the coast and the sudden and sometimes catastrophic "El Nino" phenomenon, have attracted the interest of ocean scientists for many years.

The economic, social and environmental impact of these two features on Peruvian society, and on the whole world, has motivated the organization of several large oceanographic expeditions to the coast of Peru. Due to the extent and the diversity of information acquired, the expeditions of international cooperative programs that have taken place during the last fifteen years are most important.

Unfortunately, much of the data that has been collected at high cost and effort for so many years is not centralized and is, therefore, not readily available to potential users in Peru or elsewhere. This is particularly true for physical oceanographic data, since much biological and chemical data have been assembled by the fisheries institutes.

The Peruvian Navy requires an easily accessible oceanographic data bank to be able to provide information to its ships and submarines about ocean conditions under which they operate, and to make ocean forecasts for naval operation areas. However, the task of assembling a data bank is difficult because many of the data are not available in a computer accessible form and because no single institution or agency in Peru has

archived all of the available historical data. In addition, the advantages of having an oceanographic data bank in Peru will benefit the fisheries, oceanographers, and scientific research in general, as well as the Navy.

In 1973, the Naval Hydrographic Office (Direccion de Hidrografia y Navegacion de la Marina--DHNM) was assigned the task of implementing a "System of Oceanographic Information" (Sistema de Informacion Oceanographico, or SIO). This system was envisioned as consisting of an oceanographic data base that would provide services to several users. There would need to be a long term program of oceanographic data acquisition to update the data bank on a continuing basis. The system would also have a mechanism for exchanging data with other local and foreign institutions.

This thesis is a pilot study for the organization of a data bank for the Peruvian Navy that will eventually be part of the SIO. The scope of this work has been focused on the assembly of all available historical oceanographic data for areas in the vicinity of Peru. The historical data was mainly extracted from the Master Oceanographic Observation Data Set (MOODS) files of the Fleet Numerical Oceanographic Center (FNOC) in Monterey, California. After the data were selected, a simple system was designed to identify and store them in an orderly manner.

This thesis has been divided into six chapters. The first chapter is an introduction. The second is an historical review of the data acquisition programs that have taken place off the coast of Peru with a brief description of the most important. The third chapter reviews the phenomena of upwelling and "El Nino" and their impact on the guano and

fisheries industry in Peru, pointing out the importance of oceanographic data for study, monitoring and eventually predicting such features. It also presents justification for having a long range program of data acquisition to update the data bank. The fourth chapter introduces the MOODS system which was used in the selection and processing of the data, commenting on the advantages and disadvantages of implementing a similar system for the SIO. The fifth chapter presents some examples of practical applications of the data and discusses future possible uses of the bank. The last chapter presents the conclusions.

II. OCEANOGRAPHIC DATA FROM PERUVIAN WATERS

A. HISTORICAL REMARKS

Ever since 1811 when A. Von Humboldt described [Humboldt, 1826] what is now called the Humboldt or Peru current, many scientists and investigators have studied the coastal waters of Peru. It is difficult to identify when the peculiar characteristics of the cool waters of the Peruvian coast first drew the attention of the people living or traveling along this narrow strip of land. However, there are several Spanish documents dated as early as 1540, issued to the King of Spain, that report [Murphy, 1937] on the geographical and climatic characteristics of the newly conquered land. The cool ocean waters, the almost total lack of rain, and the abundance of marine life were the most striking features for the newcomers, who reported how they cooled their drinks by hanging flasks over the side of their ships.

One of the most notorious characteristics that concerned the Spanish, however, (because of its implications for navigation) was the origin and path of the sometimes strong northward current that affected the route of the ships sailing between Panama and Callao. An excerpt [Zarate, 1555], from the "Account of the Country" written by Treasurer-General Zarate to the Spanish King in 1543, indicates their preoccupation with this fact:

> "This constant wind and current render the navigation exceedingly difficult from Panama to Peru for the greater part of the year; so that vessels are obliged always to tack to windward against wind and current."

Since the time of the Spanish conquest, many other travelers, scientists and navigators have referred to this phenomenon and tried to explain its

cause. Some of these observations were of commercial value because of the increasing trade and shipping between Peru and Europe via Panama. The Spanish and Portuguese sailors were already aware of the existence of these strong ocean currents. By 1519, they had discovered the advantage of sailing with favorable equatorial currents across the Atlantic to America and returning northward along the Florida Strait in the Gulf Stream as far as Cape Hatteras and then eastward to Spain and Portugal.

Aside from the commercial importance of the currents, there were many pioneering scientists who started to systematically acquire physical and biological information for scientific investigation. In the second half of the XVIII century the thermometer was already available and many navigators wrote of the importance of temperature observations for determination of current boundaries. In 1802, Von Humboldt attempted a global interpretation of the temperature measurements on the Peruvian coastal current [Humboldt, 1926]. Even though he incorrectly concluded that the low temperature was due to the Antarctic origin of the flow (actually the cool water comes from upwelled subsurface water, from Antarctic origin), he was still the first to attempt a comprehensive scientific study and interpretation of this current that still bears his name. After Humboldt, other investigators started to look for additional explanations for this oceanic phenomenon. Because of its importance in the circulation of the Pacific Ocean, many governments, private institutions and entrepeneurs became aware of the benefits of such investigation and began to organize and fund large oceanographic expeditions to acquire scientific data.

B. OCEANOGRAPHIC EXPEDITIONS

In 1823, 1836 and 1837-8, three French expeditions acquired information along the coast of Peru to corroborate Humboldt's theory [Dupery, 1829]. In 1835, the well known expedition by the Beagle accompanied by Charles Darwin visited the coast of Peru and collected biological data [Fitz Roy, 1839]. The assembly of these new data was followed by new theories and interpretations: De Tessan (1844) hypothesized that the low water temperatures were due to upwelling. In 1874, Dinklage added another piece of evidence to the puzzle by pointing out the importance of the trade winds in the westerly set of the surface flow [Gunther, 1936].

The first few years of the XIX century saw a profusion of new theories concerning the explanation of the Peru Current. Sverdrup, Schweigger, Vallaux and Schott were a few of the oceanographers who investigated the Peru Current and the already known "El Nino" countercurrent using more advanced instrumentation and techniques [Gunther, 1936].

During the decade of the 1930's, Sverdrup [Sverdrup, 1930] and Schweigger [Schweigger, 1931] published the first coastal and open ocean observations acquired with subsurface instruments. The data included temperature, salinity, pH and current velocity. These expeditions were so useful in learning about the characteristics of the area that others were encouraged to organize more elaborate data acquisition programs.

In 1928-29, the cruises of the Carnegie [Gunther, 1936] yielded valuable data across the Eastern South Pacific, not only along the coast, but from offshore waters to as far as 115 W and from the Equator to 40 S. Sverdrup's interpretation of the resultant temperature and salinity sections contributed to a better understanding of the limits of the system of oceanic currents and undercurrents along the coast of Peru.

In 1931 the British ship R.R.S. William Scoresby made an extensive survey from the Equator to 40 S acquiring meteorological data and observing temperature, salinity and phosphate concentration from the surface to 400 meters deep. The results of the Scoresby expedition are presented in an extensive report [Gunther, 1936]. After this expedition, and particularly during the 1960's, many well-organized oceanographic cruises have been conducted along the Peruvian coast. The following is a list of some of the most important modern expeditions. Many other short cruises by local and foreign institutions that have taken place in this part of the ocean are not included.

TABLE 1

Data Collection Programs 1950's-1970's

Year	Name	Program or Institution
1952	Shellback Expedition	Scripps Institution of Oceanography
1953	Yale South American Expedition	Bingham Oceanographic Laboratory
1960	STEP-1 Expedition	Scripps Institution of Oceanography
1967-8	(several)	EASTROPAC Program
1972	El Nino Watch Expedition	Scripps Institution of Oceanography
1976	JOINT II Experiment	CUEA Program

The last three expeditions deserve special commentary because they were large data acquisition and experimental programs that greatly added to the amount of information available from this part of the ocean. Many other cruises done by local institutions also exist and will be incorporated into the bank.

1. EASTROPAC Program

In 1960, at the seventh conference of Eastern Pacific Oceanic Conference (EPOC), the members of this organization discussed the sparse and infrequent data acquired in the Eastern Tropical Pacific. From these discussions, it was concluded that in order to understand and predict the variations of the circulation of this area, a more complete data base was necessary. An ambitious program of geological, geophysical, meteorological, as well as physical, chemical and biological oceanographic data acquisition was proposed. After several years of delay, the original program was somewhat reduced, fisheries surveys were added, and the revised program adopted its definitive name, Eastern Tropical Pacific Program (EASTROPAC). This was to be a cooperative effort towards understanding of the oceanography of the Eastern Tropical Pacific Ocean. The program included the participation of U.S., Mexican and Latin American institutions. The fieldwork was divided into seven 2-month cruises of the area between 20 N and 20 S and from the coast of North and South America to 119 W. Five of these seven periods of observations were conducted adjacent to the Peru coast during the months of: Feb-Mar 1967, Jun-Jul 1967, Aug-Sept 1967, Oct-Nov 1967 and Feb-Mar 1968. These particular cruises included the participation of four U.S. ships and one Peruvian ship. The information acquired was primarily physical and biological oceanographic data but included meteorological observations as well. All the observations during this program were processed and presented in eleven volumes as the "EASTROPAC ATLAS".

EASTROPAC was the first successful international program for the comprehensive acquisition of data in the Eastern Pacific. It was an

instructive experience for all of the participants in the organization of this kind of international cooperative program, and it would prove to be a valuable experience that was to be repeated many more times during the following decade.

2. El Nino Watch Expedition

In October 1974, based on previous studies done on the "El Nino" phenomenon, a prediction was made [Quinn, 1974] that a weak El Nino event would occur in early 1975. A group of scientists sponsored by the Office of Naval Research and the National Science Foundation of the United States organized a multidisciplinary expedition to observe the conditions offshore of Ecuador and Peru. The expedition consisted of two cruises that surveyed the area from 2 N to 14 S, and 95 W to the coast. The first cruise took place from mid-February through March 1975 and the second from mid-April through May of the same year. The data acquired included CTD casts to a depth of 500 m, Niskin casts, XBTs, vertical zooplankton net tows, current measurements and meteorological variables. This information has been analyzed and presented in the "El Nino Watch Atlas" [Patzert, 1978].

3. CUEA Program

In 1966, a group of scientists and government officials in the U.S. proposed a ten year systematic program of cooperative international ocean exploration. This was the beginning of what was to become one of the most significant events in recent oceanographic history, the International Decade for Ocean Exploration (IDOE).

This ambitious program which took place during the decade of the 1970's was motivated by the future uses of the marine resources as well

as by scientific curiosity. It included the participation of many nations. By October 1978, 37 nations were involved in one or more of the various parts of IDOE programs. The original idea of IDOE was to promote an international, interdisciplinary and inter-institutional approach to improve our understanding of the oceans. One of the objectives that was included in the context of IDOE, was that of "Environmental Forecasting". Later on, an objective entitled "Living Resources" was included. Under the auspices of these two objectives, the Coastal Upwelling Ecosystem Analysis (CUEA) program was created. CUEA was a multidisciplinary research program designed to investigate coastal upwelling and its biological consequences. It was planned on the basis of a series of earlier investigations off Oregon and Northwest Africa in the mid-1960's and off the coast of Peru in 1966 and 1969 [Costlow and Barber, 1980]. CUEA included several field programs with ships from eight countries participating in the intensive periods of observation. Four small and two large field operations were conducted in the regions of upwelling. The large operations were named JOINT-I, conducted off North West Africa and JOINT-II, off Peru. JOINT-II was a U.S.A.-Peruvian effort of data acquisition and experimentation. It was divided into three periods of intense observations: March-May 1976 (MAM 76), July-November 1976 (JASON 76) and March-May (MAM 77). Seven U.S. and two Peruvian ships participated in the data acquisition. The U.S. provided aircraft, satellites and eight shore-based meteorological stations, and Peru provided logistic support for the aircraft and meteorological stations, as well as a coordination center at the Instituto del Mar del Peru, in Lima.

CUEA has produced one of the most comprehensive sets of data ever collected off the coast of Peru. The results of the field, laboratory and theoretical studies will be a valuable source of data for future investigations in this area.

III. THE IMPORTANCE OF AN OCEANOGRAPHIC DATA BANK IN PERU

A. THE FISHERIES

It is a well known fact that the surface water close to Peru is much colder than what is expected at these latitudes. The temperature was so low that Humboldt thought that the northern current originated in Antarctica. However, in 1844 De Tessan, correctly attributed the low temperature to upwelling of subsurface water (from 100 to 300 m) along the coast. Upwelling is a process whereby subsurface water rises toward the surface. Coastal upwelling results when prevailing winds produce offshore flow in the surface layer near a coastal boundary [O'Brien, 1978].

Areas of coastal upwelling cover only 1% of the oceans, but they contain more than half the world commercial fish stocks. Coastal upwelling occurs along virtually all coasts. It is very intense in several places such as the coasts of California-Oregon, Northwest and Southwest Africa, Arabia, and western South America. In some of these regions, the phenomenon is seasonal (especially in mid-latitudes), whereas off Peru, it occurs throughout most of the year.

Upwelling is of particular importance because it can raise great quantities of phosphates, nitrates, silicates, and other nutrients from subsurface waters. The presence of these nutrients in the photic zone greatly enhances photosynthesis and as a result, algae and phytoplankton flourish. Along the coast of Peru, this great productivity in plant life provides the basis for a prodigious food chain which supports a large fish population, including the largest population of anchovies and

ocean birds found anywhere. As a result, the commercial fishery harvest is enormous. In 1970, Peru accounted for more than one fifth of the total world fish protein production [O'Brien et al, 1981].

However, this productivity at the top of the food chain is not very stable. In the northern part of Peru, a tongue of Equatorial Counter-current water annually intrudes southward along the coast from the Gulf of Guayaquil. It is of 6° to 7°C warmer and much less saline than the surface water it displaces. This event usually occurs during the Christmas season and is, therefore, known as "El Nino", which means "The Child", the popular name given to the Child Christ, symbol of the Christmas season. "El Nino" occurs every year with its warm waters penetrating to 6° or 7°S. In some years, this countercurrent is stronger than normal and it may reach as far as 12°S or more, causing a catastrophic destruction of plankton and fish life. In "El Nino" years, the large anchovy population which is adapted to the cold upwelled water, either scatters in search of cooler water or it migrates offshore. Many fish die prematurely, dramatically reducing the stock. Large number of seabirds that mainly feed on these anchovies die of starvation, and the guano (seabird fecal deposits used as fertilizer) yield is reduced with a deleterious effect on agriculture. The effects of "El Nino" are evident in the atmosphere as well. In severe "El Nino" years, the northern coastal areas experience torrential rains causing flooding in the farmlands along the river valleys.

The social and economic impact of this event in Peru is well documented [Murphy, 1954; Caviedes, 1975; Paulik, 1981]. In 1960, the fishmeal industry alone represented 35% of total national foreign

earnings [Paulik, 1981]. In 1972, a combination of very intense fishing and a long and intense "El Nino" caused the collapse of the fishing industry. The economically important guano mining industry also felt the effect of this phenomenon in the late 1930's. The economic effects are felt worldwide in the price and supply of fertilizers and fishmeal. In 1973, a sharp rise in the price of chicken in the U.S. was due to the unavailability of fishmeal used as chickenfeed [O'Brien, 1978]. Prices of soybean meal, which competes with fishmeal as animal feed, increased due to reduced supplies of fishmeal on the world market.

The "El Nino" phenomenon is an important example of a complex ocean/atmosphere interaction whose causes are still not fully understood.

Much effort has recently been made to understand the interaction between atmospheric and ocean conditions that precede the initiation of an "El Nino", yet more data are needed to improve any predictive capabilities for the onset of the event. The far reaching effects of "El Nino" on the Peruvian economy and on the world supply of fertilizers and fishmeal has encouraged the scientific community to try to understand the behavior of this phenomenon by the acquisition of more data. In recent years, there have been numerous studies of this event that used these data. It is now important to update and organize these data to better document "El Nino" and its variability. It is also important to share these data between the countries of the region that are affected by the "El Nino" (Ecuador, Chile, Peru and Colombia) under programs such as ERFEN (Regional Study of the "El Nino" Phenomenon).

B. THE NAVY

The onset of "El Nino" with rapidly changing conditions of the water masses along the coast also changes the acoustical characteristics of the ocean in this area. The Navy is interested in this variability because of its effects on underwater sound propagation for antisubmarine warfare (ASW).

Because of the historical economic impact of "El Nino" and its consequences for Naval operations, it is necessary to develop an oceanographic data bank to archive all available historical ocean data for Peruvian waters and also to update the data bank with new information on a continuing basis to monitor and eventually to predict ocean conditions.

Several years ago, the Peruvian Navy began a study of the physical characteristics of the ocean waters along the coast to provide its ships and submarines with information on the environment in which they operate. The Peruvian Naval Hydrographic Office (DHNM) was assigned the responsibility of collecting data available from local sources. Because of the need for rapid access to the data and for rapid preparation of summaries in different forms, the data were to be in computer accessible form. The DHNM searched for physical oceanographic data in government offices and fisheries institutions but found very little in computer accessible form, and ultimately most of the information acquired came from the U.S. National Oceanographic Data Center (NODC).

This lack of computer accessible oceanographic information from local sources lead to the concept of a data bank for the Navy and other users in which all the data acquired along the coast of Peru for many years by local and foreign sources could be organized in such a way so

as to be of immediate use. The potential benefits from the organization of such a bank include the incentive it will provide for students of marine sciences and other related investigations. Its creation should encourage the Peruvian Navy to implement a strong program of oceanographic data acquisition with Navy ships and other platforms. It should also encourage other sources, local and foreign that acquire oceanographic data to provide it to the bank on an exchange basis. Finally, it will create a mechanism to archive the information gathered by foreign ships that come to Peru on future oceanographic expeditions. On the basis of these considerations, the Peruvian Navy decided to commission the organization of an oceanographic data bank.

C. THE CREATION OF THE BANK

On March 11th 1977, the Government of Peru issued the Decree Law D.S. #033-77-MA by which the responsibility for the creation and organization of the Oceanographic Information System or Sistema de Informacion Oceanografico (SIO), was assigned to the Hydrographic Office of the Navy.

The first step in the organization of such a system is the collection and inventory of all available historical information. As is evident, a large amount of data has been acquired along the coast of Peru for many years. Finding and identifying this data today is difficult because of the diversity of the sources and data formats.

Although a significant effort has been made by various institutions over the years in the acquisition of data, much of this valuable information remains scattered in the archives of those institutions. In recent years, however, efforts have been made to try to centralize and standardize the acquisition of data from all over the world. Two such central

facilities are (NODC) and World Data Centers A and B in Washington D.C. and Moscow, respectively.

The organization of the historical data is only the initial step in the creation of the oceanographic data bank which will support the SIO. Next, there needs to be careful planning for the establishment of procedures to acquire additional data to update the data bank, and for the implementation of such procedures. There are many considerations in planning the future acquisition of data: special projects or areas of study, user requirements, existence of historical data, availability of platforms for data acquisition, Navy priorities, etc.

The creation of the SIO will require that the DHNM organize a network of data-acquisition platforms that can provide the data to update the bank on a continuing basis. This can be done in part by use of Navy ships as well as fishing and commercial ships of opportunity. The use of ships of opportunity has already enabled the monitoring of atmospheric conditions along the coast of Peru, and they could also be used for acquiring oceanographic data. The implementation of such a monitoring system is not simple but can be accomplished by sharing both the responsibilities and the benefits of the program with others. For example, FNOC already has a global ship of opportunity program in existence. Data acquired by these ships provide a large scale monitoring and temperature conditions in the Pacific Ocean and a few of the ships make expendable bathythermograph observations in the Eastern Tropical Pacific.

The implementation of the SIO will be divided into three main stages:

1) the acquisition and organization of the existing historical data;

2) the establishment of procedures for monitoring, assembling and exchanging of new data to update the data base on a continuing basis; and

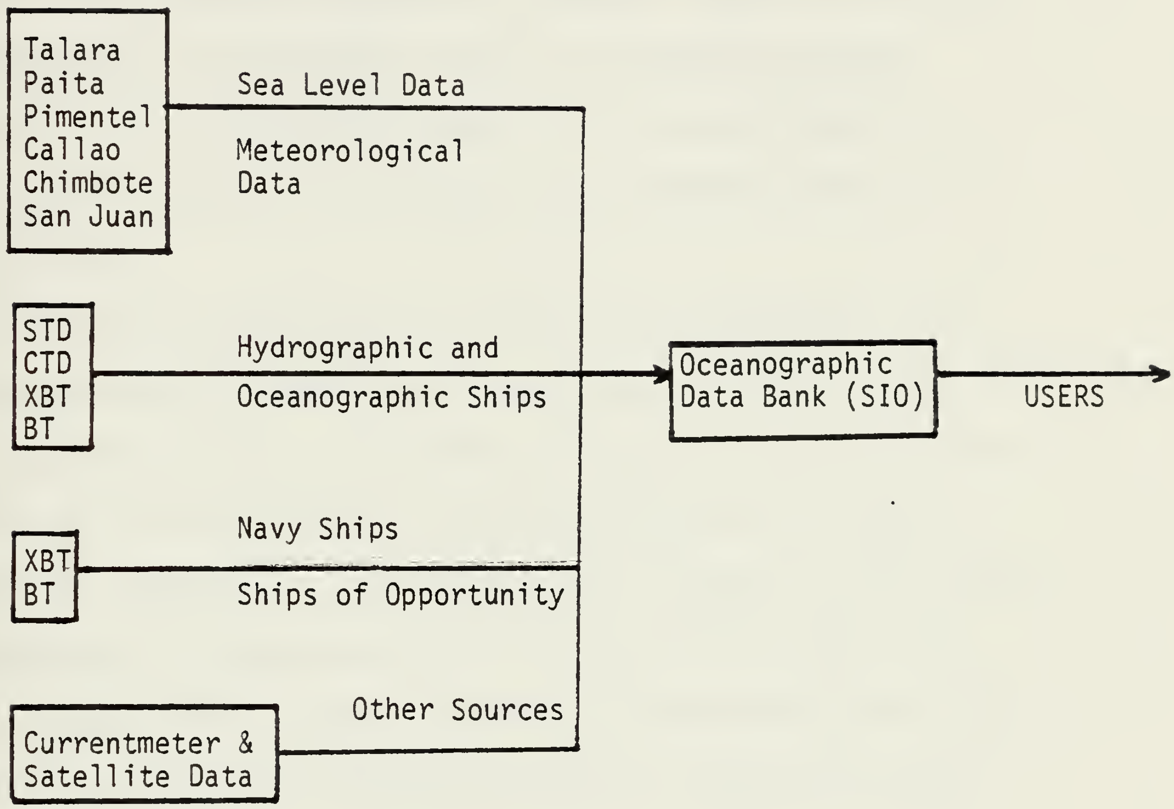
3) the implementation of computer analysis programs and application products to provide services for users.

The scope of this thesis is devoted to the first of these steps, that is, the compilation from numerous sources of all available historical data from the coastal waters of Peru. More specifically, the focus is on the design and implementation of an archiving system of primarily physical oceanographic data. One purpose of this thesis is to provide some ideas and examples of possible applications of the available historical data. A final purpose of this thesis is to conduct a pilot study and test of some of the systems already in existence for the management of oceanographic data. The programs developed for the processing of the data will be transferred to the computer facilities of the Peruvian Navy where they will be tested to start the implementation of the SIO. Next, all available physical data will be acquired and introduced to the system to update the bank. Table 2 shows how the flow of information will update the bank in the future.

One of the main accomplishments of this thesis is that it has provided experience in working with programs and data sets similar to those that will be used for the SIO. This experience will be very valuable in the design and implementation of the oceanographic data bank for the Peruvian Navy.

TABLE 2

Flow of Information Into the Bank



IV. ORGANIZATION OF THE BANK

A. THE IMPORTANCE OF DATA FORMATS

The way in which data are recorded is a central issue in the design of any computerized data management system. The computer does not recognize what the data represent; rather, it is the programmer who formats the data for input to the computer as an ordered pattern of binary digits or bits.

There are several different ways of formating oceanographic data. Some formats are more efficient than others depending on the type of data and the applications for which the data are to be used. It is also important that the available computer efficiently supports the format. During the last fifteen years, the improvement of computers and of sophisticated techniques for archiving and retrieving data from large data bases has increased the efficiency of managing oceanographic data. Recently developed systems save considerable amount of memory space and computer time.

As an example of improving data storage techniques, in 1966 the North Atlantic ocean station file of the U.S. Naval Oceanographic Office (NAVOCEANO) was stored on sixty-four reels of tape. By the simple technique of grouping single card images into blocks of ten card images per tape record, the physical size of the file was reduced from sixty-four to twenty-one reels of tape [Yergen, 1970]. This saved considerable space and reduced the complexity of making computer summaries of the data. Later, in the same year, NAVOCEANO restructured the same file

into an experimental format called "rapid access" format Yergen, 1967 . This format further reduced the twenty-one reels to three reels of magnetic tape and made the data very accessible.

The new, more efficient scheme used a binary number format rather than the former binary coded decimal (BCD) character format. In this way, the size of the file was reduced and conversions between BCD and binary numbers eliminated. Elimination of the BCD-binary conversion speeds the processing since binary is the natural arithmetic base system of most computers. Reducing the physical size of the file not only saves space and simplifies computer runs but also reduces the actual time needed to transport the tape past the computer's tape-read heads.

There are several disadvantages of binary data, however. Most important is that data are commonly exchanged between computers in character form and many users are unfamiliar with binary data. Also many common compilers (such as IBM FORTRAN) do not contain features to easily handle binary data. Thus, the user is forced to develop special subroutines to pack and unpack the data. Fortunately efficient, FORTRAN callable, machine language subroutines are available for many computers, based on work at the National Center for Atmospheric Research Jenne, 1979 and Scripps Institution of Oceanography Hilton, 1974 . These are the routines SBIT/SBITS and GBIT/GBITS which pack and unpack bits or strings of bits.

An example of the volume and computer time saved on a Control Data Computer (CDC) by using binary packed rather than BCD data is given below [Jenne, 1974]. For a number in the range 0 to 4095 in magnitude (such as ocean temperatures in the range -1.8°C to 35.0°C, stored as

hundredths of a degree Celsius, -180 to 3500 units, and biased by +2.0°C or 200 units to be in the range 20 to 3700 units) the following number of bits are required for storage:

Volume comparison:

Storage Method	Volume Per Number
Binary Packed	12 Bits
BCD (6 Bit Character)	24 Bits
BCD (8 Bit Character)	32 Bits

Also, the amount of time required to convert the number for use in calculations is as follows:

Type of Data	Time to Unpack It
Binary (12 Bit Number Using Machine Language)	3 microseconds
Binary (12 Bit Number Using Fortran Subroutine)	20 microseconds
BCD Characters Using Fortran Subroutine	120 microseconds

As can be seen, considerable time and space is saved by using binary packed data when working with large volumes of data. In the above examples, there is about a three-to-one compaction and about a forty-to-one saving in time.

Ever since the computer became an indispensable tool for storing and processing large amounts of data, many storage devices have been used for archiving and exchanging information between data centers. Punched cards, punched paper tapes, magnetic tapes, and disks have all been used for this purpose. Today, because of its versatility and low

cost, magnetic tape is a common storage device and its standardization by all major computer manufacturers has simplified the exchange of data on tape between users. However, even though magentic tape has become a standard medium, many different formats are used to store oceanographic data. The increasing diversity of ways of acquiring oceanographic data, together with the variety of applications for the data has encouraged the design of many different formats each suited to the user's particular needs and computer facilities. Based on the earlier work of Yergen, Jenne, and others, the Master Oceanographic Observation Data Set (MOODS) was developed by Fleet Numerical Oceanography Center (FNOC) as an attempt to merge all available ocean profile data globally for rapid access by computers for naval purposes.

B. HISTORICAL DATA FORMAT (MOODS)

The main source of historical data for the coastal waters off Peru was extracted from the MOODS archives of FNDC. During the last few years, efforts have been made at FNOC to acquire all available oceanographic profile data from files of the U.S. National Oceanographic Data Center (NODC) and other sources in order to make the existing oceanographic data easily accessible to operational users. The data conversions and programs to handle the MOODS data were written in Fortran IV by Compass Systems, Inc. and implemented on a CDC 6500 computer at FNOC.

The MOODS system was designed to meet five objectives: (1) simplification of computer software to handle a single format of ocean profile data rather than the multiple formats used previously, (2) compaction of the data files from more than 50 reels of tape to just a few reels (or ultimately, a single disk pack), (3) rapid access by computer, (4) ease

of data exchange between computers of different manufacturers. The data are stored as binary integers, biased to be positive integers to eliminate problems of handling negative binary numbers. For further compaction of the data, values in each profile are stored as differences rather than actual values.

C. DESCRIPTION OF THE MOODS FORMAT

The MOODS files are sorted by time and position (both to the accuracy of minutes), source and ship files in such a way that records can be sorted and extracted in any combination of time, one degree areas, ship and source files. The information packed into a MOODS record, corresponding to one complete ocean profile, is divided into several fields. Each field contains information about the observation in the following sequence:

1. Day-Time Group

This is an eight digit integer that contains the year, month, day and hour of the observation (i.e., 65032110 corresponds to 1000 hours Greenwich time on the 21st of March 1965).

2. Position

Latitude and longitude are stored to the nearest minute. The hemisphere is stored as 2 bits with positive values for north and east hemispheres.

3. Cruise Number and Ship Code

The cruise number usually corresponds to the NODC cruise number. If the data were not obtained from NODC, the number used is the one coded by the source. Because the criteria used by different data acquisition organizations to select their cruise numbers are not the same,

FNOC has developed a cross-reference table to identify the ship codes and names of ships.

4. Number of Levels

This number corresponds to the discrete number of recordings taken during the original observation.

5. Number of Standard Levels

This is the number of levels at which values can be interpolated. A convenient feature of the MOODS subroutines is conversion of the data to standard levels from the original values. The standard depths to which values are interpolated can be selected by the user. This feature is especially useful in mapping the distribution of data at a selected depth, as will be seen in the last chapter.

6. Report Number

All the observations, whether BTs or hydrocasts, are numbered consecutively, and sorted by month, year, and by latitude and longitude (rounded to whole degrees). The report number is generated by a counter that keeps track of the number of observations extracted from the FNOC MOODS files. This number will eventually be altered when installed in the DHNM computer facilities in Peru because additional historical data will be added from other local sources such as the Peruvian Navy and fisheries.

7. Profile Data

The MOODS subroutines contain an array of dimension 7, corresponding to the seven possible variables that can be selected for an observation, coded as follows:

Code 0	Depth
Code 1	Temperature (in degrees Celcius)
Code 2	Salinity (in parts per thousand)
Code 3	Sigma-T
Code 4	Pressure
Code 5	Sound Speed (in meters per second)
Code 6	Oxygen (in millimeters per liter)

More than seven variables may be included in the future (such as chlorophyll), as needed. Any of these parameters or combinations of them can be selected and displayed in a table format, provided the observation contains such information. This feature also enables the user to rapidly select those profiles having the desired parameters.

8. <u>Source Code</u>

The source code identifies the source of the observation and allows the system to sort the data set by source and permits identification of individual observations. FNOC has a table of codes identifying the various sources.

D. EXTRACT FILE FOR THE PERUVIAN AREA

Extraction of all available data from the area off the coast of Peru was done by FNOC from their monthly-sorted MOODS data tapes. The limits of the area selected was from the Equator to 20°S and from 86°W to the coast. This area covers the entire length of the Peruvian coast, approximately 200 miles offshore as can be seen from Figure 1. The extracted information contains NODC mechanical and expendable bathythermographic (BT and XBT) data and hydrocast data, radio messages of BT and XBT data, Scripps Institution of Oceanography file of mechanical BT data read at 100 ft intervals, BT data digitized by Scripps

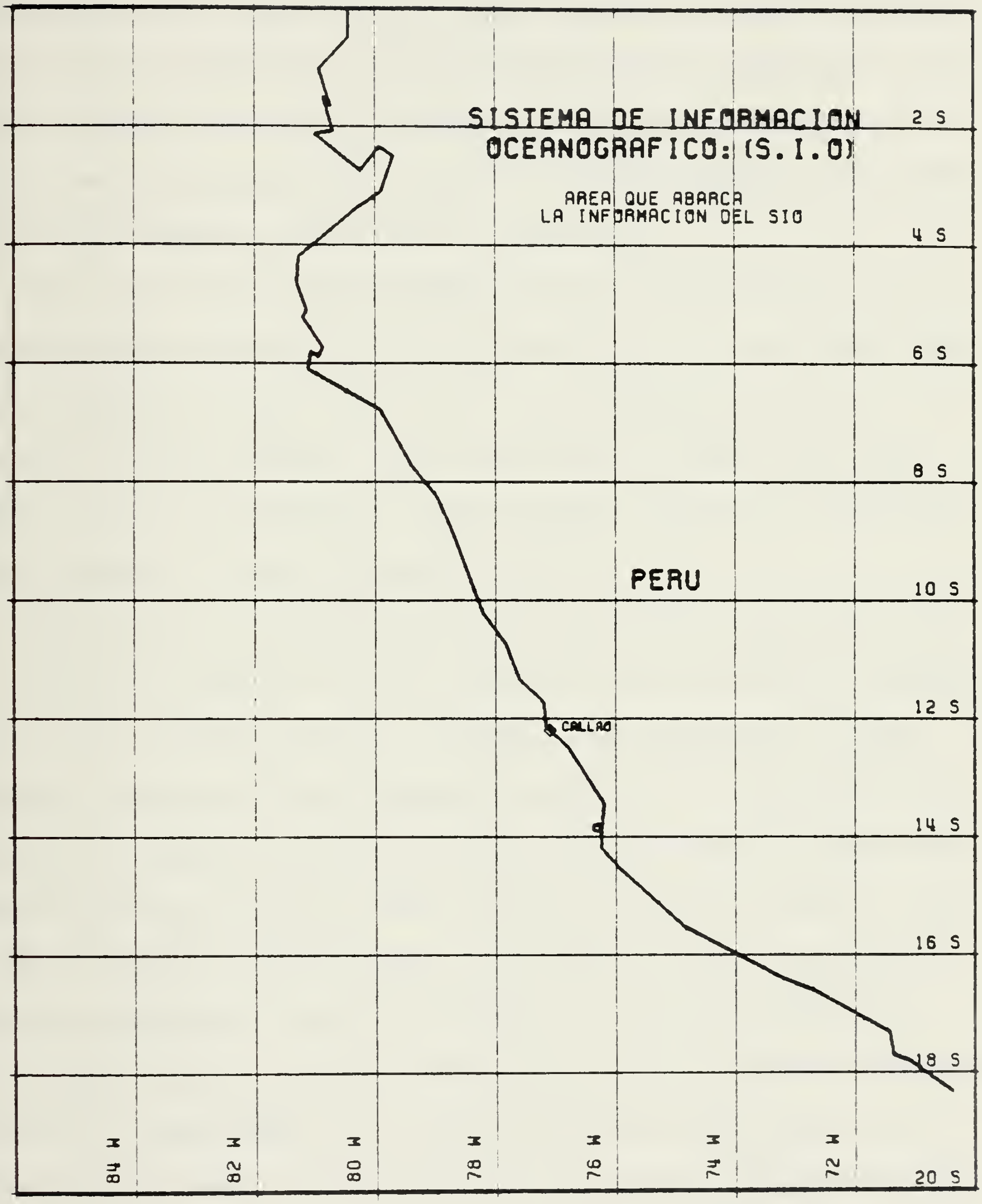


FIGURE 1: Areas Selected for Data Extraction From MOODS Monthly Tapes

Institution and Compass Systems, Inc., and British XBT and mechanical BT data.

The extracted MOODS data file was read and inventoried at the Naval Postgraduate School (NPS) using the IBM 370 Model 3033 computer. To be able to use the subroutines from the FNOC Control Data Corporation computer to unpack the data in the MOODS format on the NPS computer, the subroutine had to be modified because the Fortran languages used by the CDC and IBM computers are not directly compatible.

This conversion of the FNOC MOODS data read subroutines for use on the NPS computer and will allow the future NPS users to use MOODS format data independent of FNOC's facilities. Now that these subroutines are adapted to the NPS system, it may be worthwhile to install the global MOODS data base at the NPS W.R. Church Computer Center and incorporate the subroutines as part of the public library.

Additionally, since the Peruvian Navy has an IBM computer which will be used for the support of the SIO, MOODS files will be easily accessible using the converted routines by the DHNM for climatological purposes. In addition, new data will be processed by DHNM and will include CTD data acquired on research vessels, XBT data acquired on ships of opportunity operating along the coast of Peru, and sea level data for the six tide gauges installed along the coast. The programs that will process the current oceanographic data for the DHNM will not use the MOODS format but rather a simpler character format because of the elaborate programming required to update MOODS files and the relatively small amount of new data to be processed. The new data will be exchanged with NODC and FNOC and updated MOODS climatological tapes provided to DHNM by FNOC.

E. SELECTION OF THE DATA

Once the MOODS read subroutines were converted to the IBM computer and tested, the data were separated into two groups: bathythermographic (mechanical BT, XBT, or AXBT) and hydrocast data. The data were then listed in a convenient format (examples are shown in Appendix A). In the following chapter, it will be seen that the separation of data into hydrocast stations and BTs was done to form independent sets of data for specific applications. For example, sound speed profile analysis requires salinity information and thus can only use hydrocast data.

V. APPLICATIONS

A. INTRODUCTION

The two primary functions of the SIO are: archival of data concerning the ocean area off the coast of Peru and distribution of this information to the users. The applications of the data are the most important aspect in the consideration of the design and organization of the data bank. The effectiveness of any information system depends more on how well it satisfies the users' needs than on the level of sophistication of the system.

It is of vital importance to clearly define the problems to be solved by the users to best define the organization of the information system. Based upon the priorities and objectives of the system, the design and organization of the data bank can be suitably tailored. Many of the potential users of the SIO and their specific needs have already been identified. These are the Navy, the fisheries, other agencies and scientific researchers. In addition, there may be other potential users having specific requirements for the use of this system in Peru. Many of these are difficult to identify at this time, and their presence will be obvious only after the system is created. It is for these cases that the flexibility of the system becomes important so that it can best satisfy the demands of all users with a minimum of data processing.

Access to the SIO probably will initially be limited to a number of users having very different specific needs. However, it is very likely that additional users having other requirements may access the system

later on. Such new requests will encourage the growth and diversification of the system as well as provide new ideas for the acquisition and utilization of other oceanographic variables and the implementation of new applications.

This thesis primarily dealt with physical oceanographic data because very little of these data exist in the archives of any Peruvian institution in comparison to the large amount of chemical and biological information collected by the Instituto del Mar del Peru, the Ministry of Fisheries and other sources. Many of these biological and chemical data will eventually also become part of the data bank of the SIO.

In the following sections some of the more immediate applications and products that can be derived from the historical data collected for the data bank are presented, and other ideas of probable future use of these data are discussed.

B. INVENTORY OF THE DATA

The first task in organizing the bank is conducting an inventory of the data.

The criterion used in selecting the variable under which the data are filed is very important, and it will also depend on the specific needs of the user. The system has to be flexible enough so that different sorting parameters can be used to select the data to be retrieved and presented to the user. For purposes of illustration, two cases of retrieving the data by different parameters will be shown. These are inventories of the observations by years and by months.

The selection of year as a parameter to retrieve and display the information is useful, and it is a familiar way of displaying data

sequentially. Data presented this way is particularly useful when studying phenomena of very low frequency of occurrence; such as, "El Nino".

As stated earlier, the information collected includes bathythermographic (BT) and hydrocast observations. In order to provide a graphical representation of the geographical distribution of these two kinds of observations, three different maps were made: BT data, hydrocast data, and both types of data (Figures 2, 3 and 4). To complement the maps of the distribution of the data, a listing with the basic information of the individual observations is provided in Appendix B. The date, source and time of each observation can be obtained from this listing.

A second way in which the information can be retrieved and presented is by month. This is useful in the investigation of phenomena having regular seasonal trends. One example of the application of monthly data is the selection of representative sound speed profiles by seasons (quarterly) for certain geographic areas. This application will be discussed in more detail in Chapter IV. The monthly observations are displayed in three maps similar to that for the yearly data (Figures 5, 6 and 7). Listings for this example are also given in Appendix B.

These were just two of the many possible ways in which data can be selected and displayed. Other applications that can be derived from these data could be tables of the distribution of the data by source, year or other parameter. There can be multiple ways of selecting and displaying the data, and the user ultimately will decide the way the data are presented and sorted for specific applications.

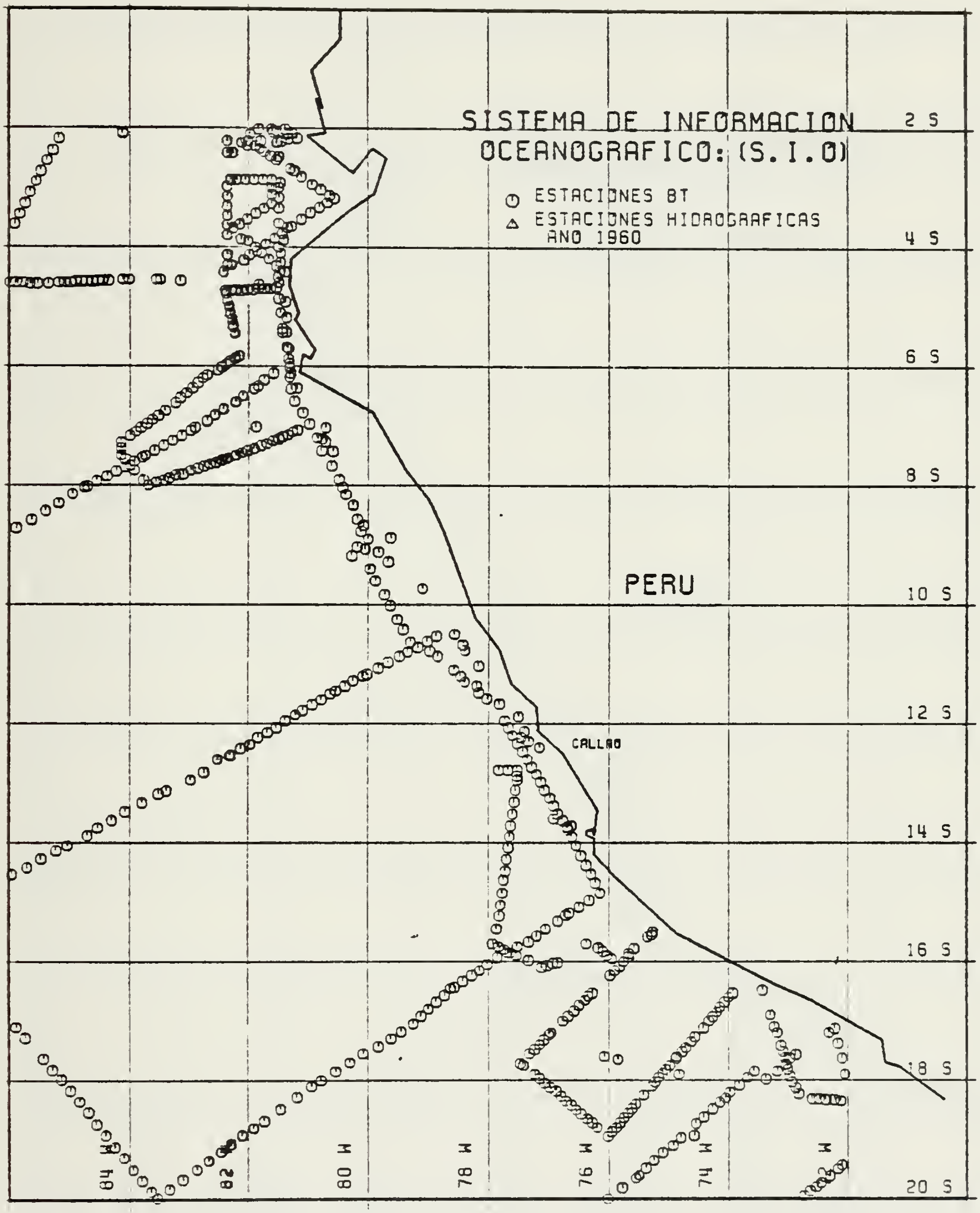


FIGURE 2: Distribution of BT Historical Data for 1960

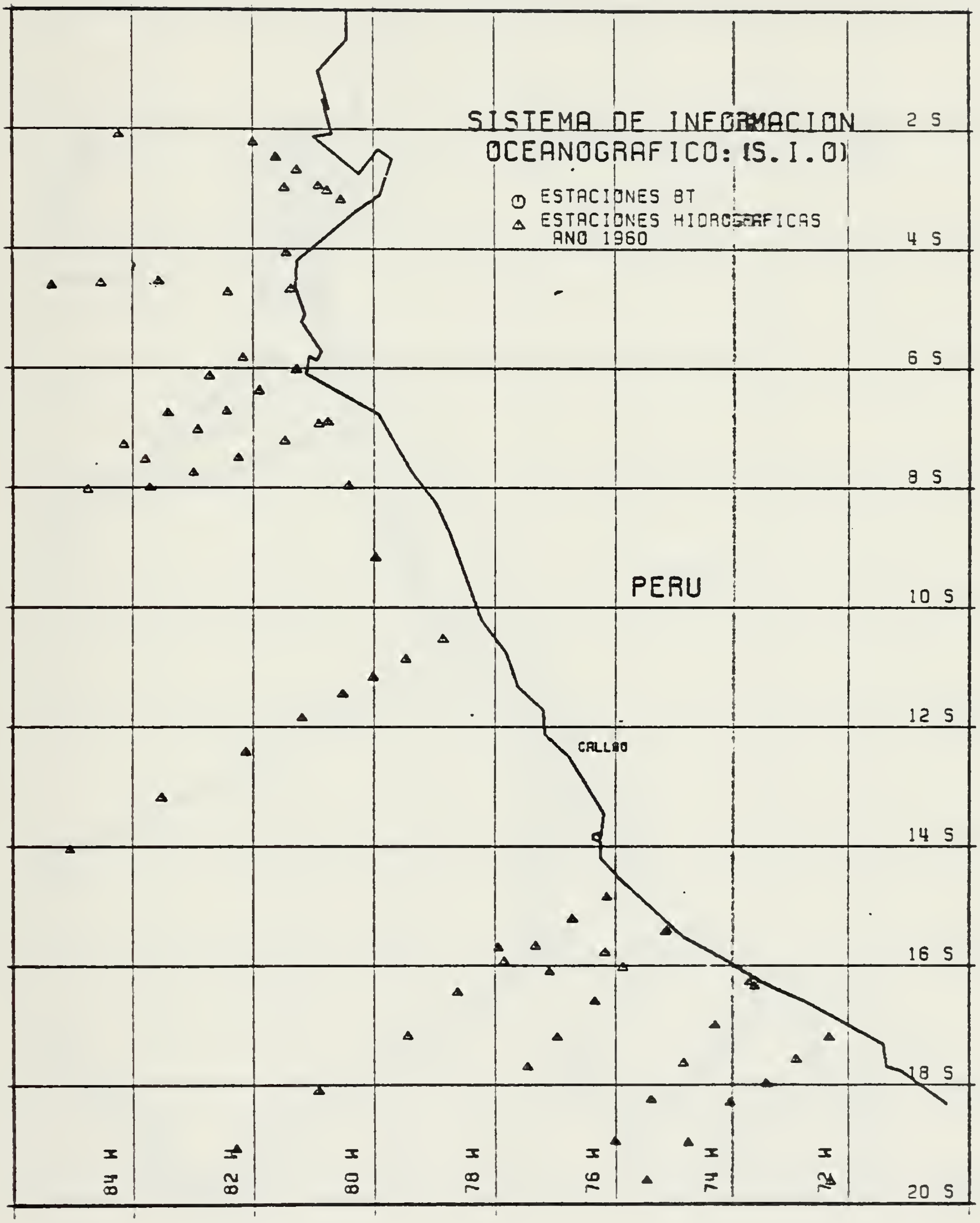


FIGURE 3: Distribution of Hydrocast Historical Data for 1960

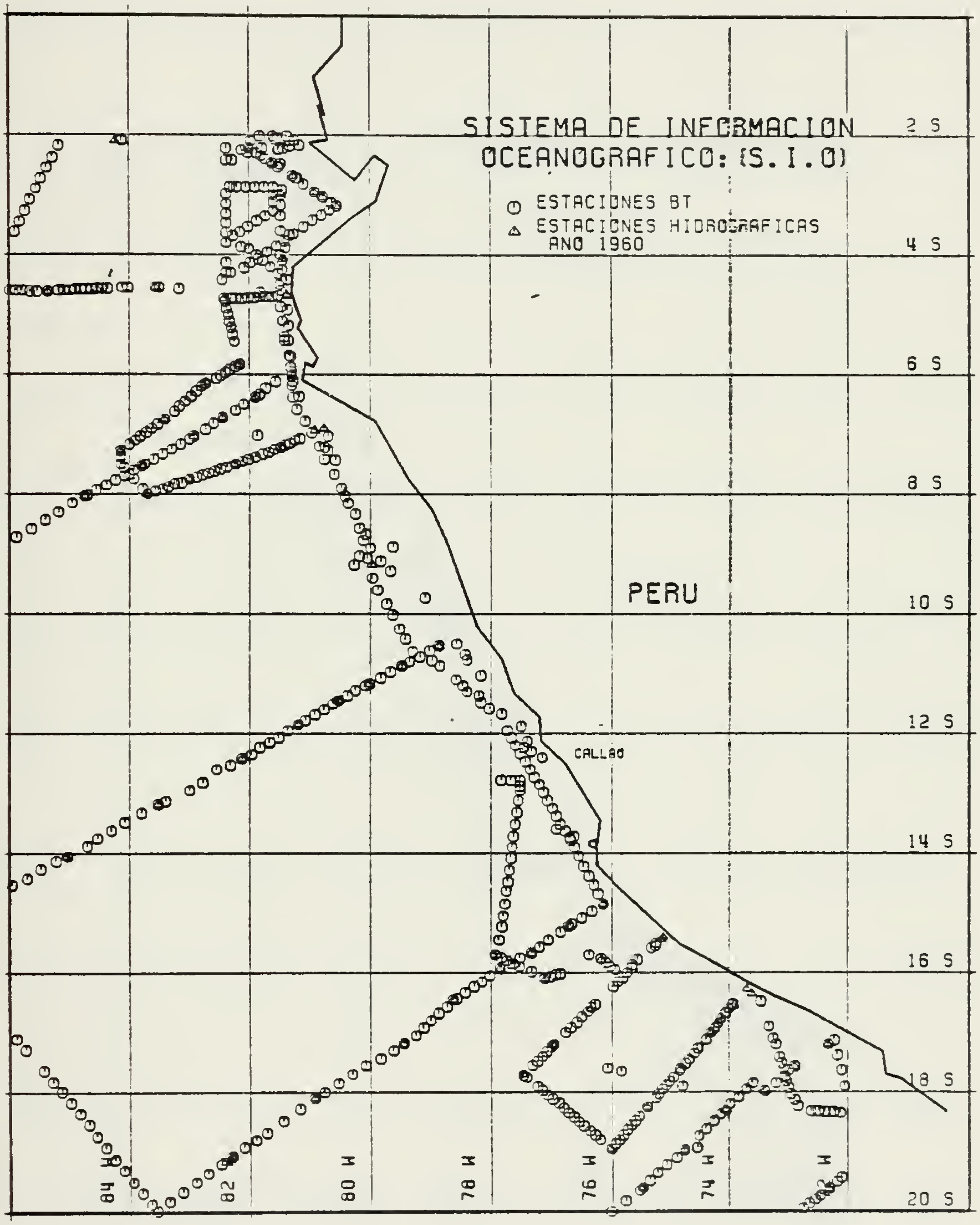


FIGURE 4: Distribution of Hydrocast and BT Data for 1960

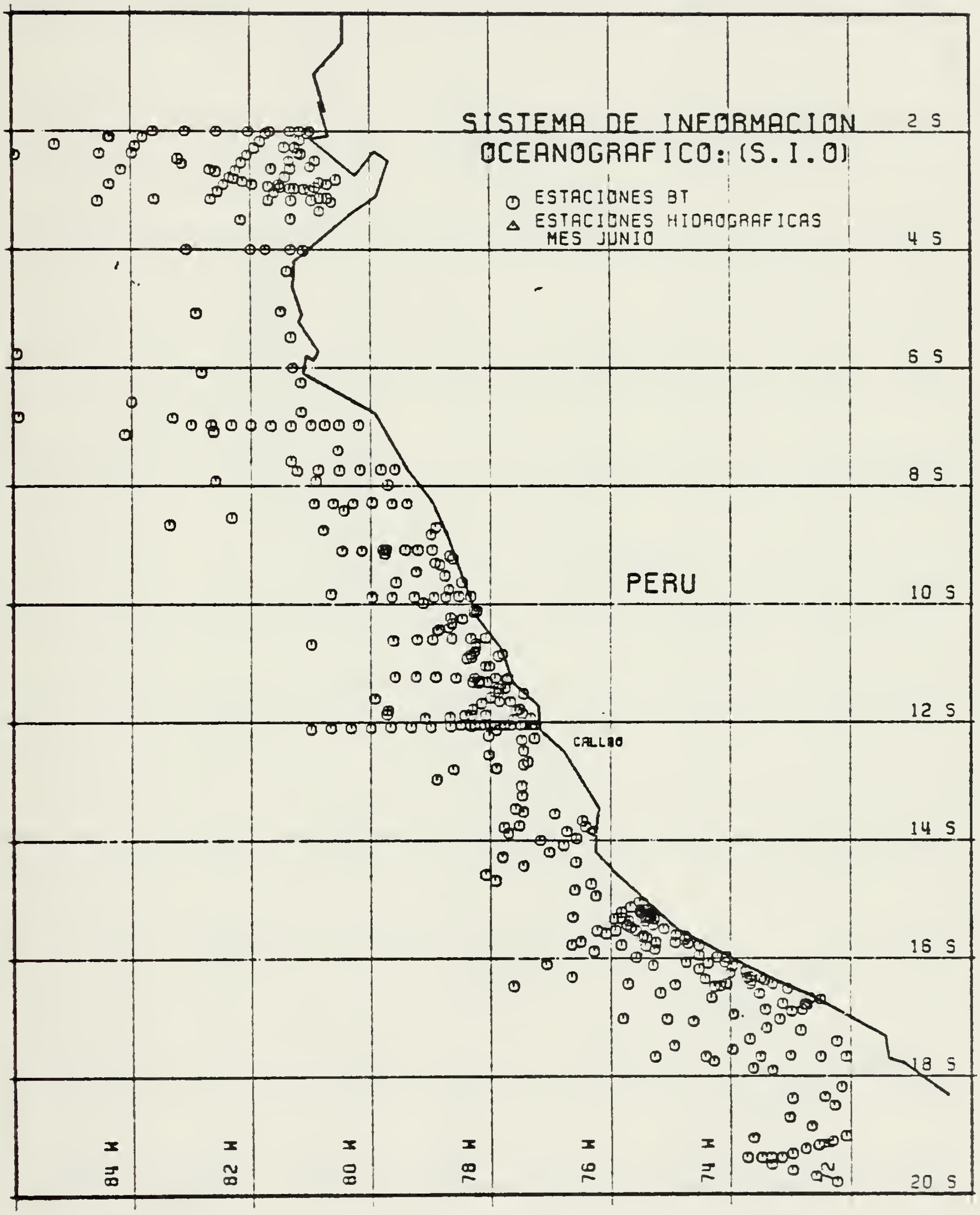


FIGURE 5: BT Historical Data for the Month of June, All Years

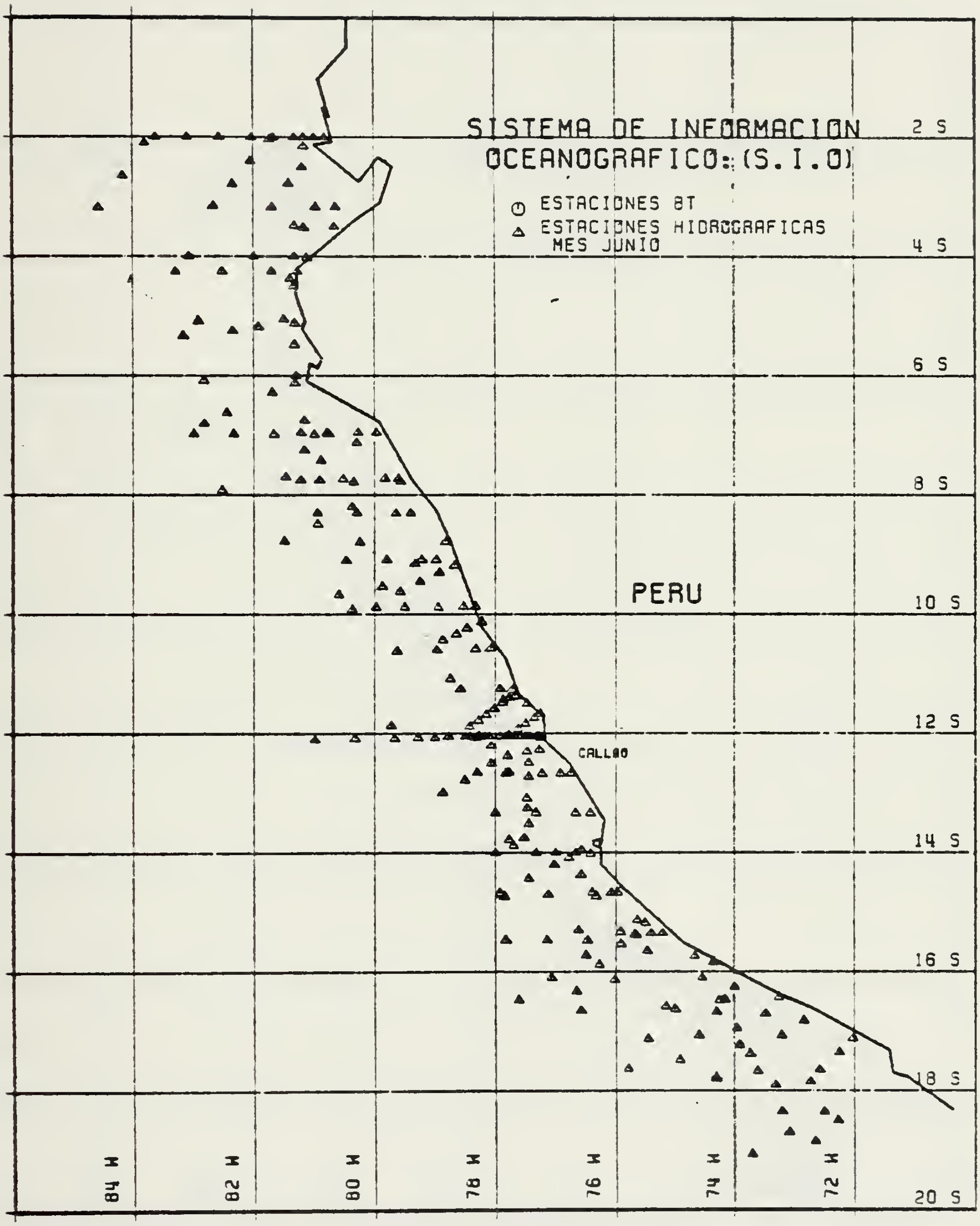


FIGURE 6: Hydrocast Historical Data for the Month of June, All Years

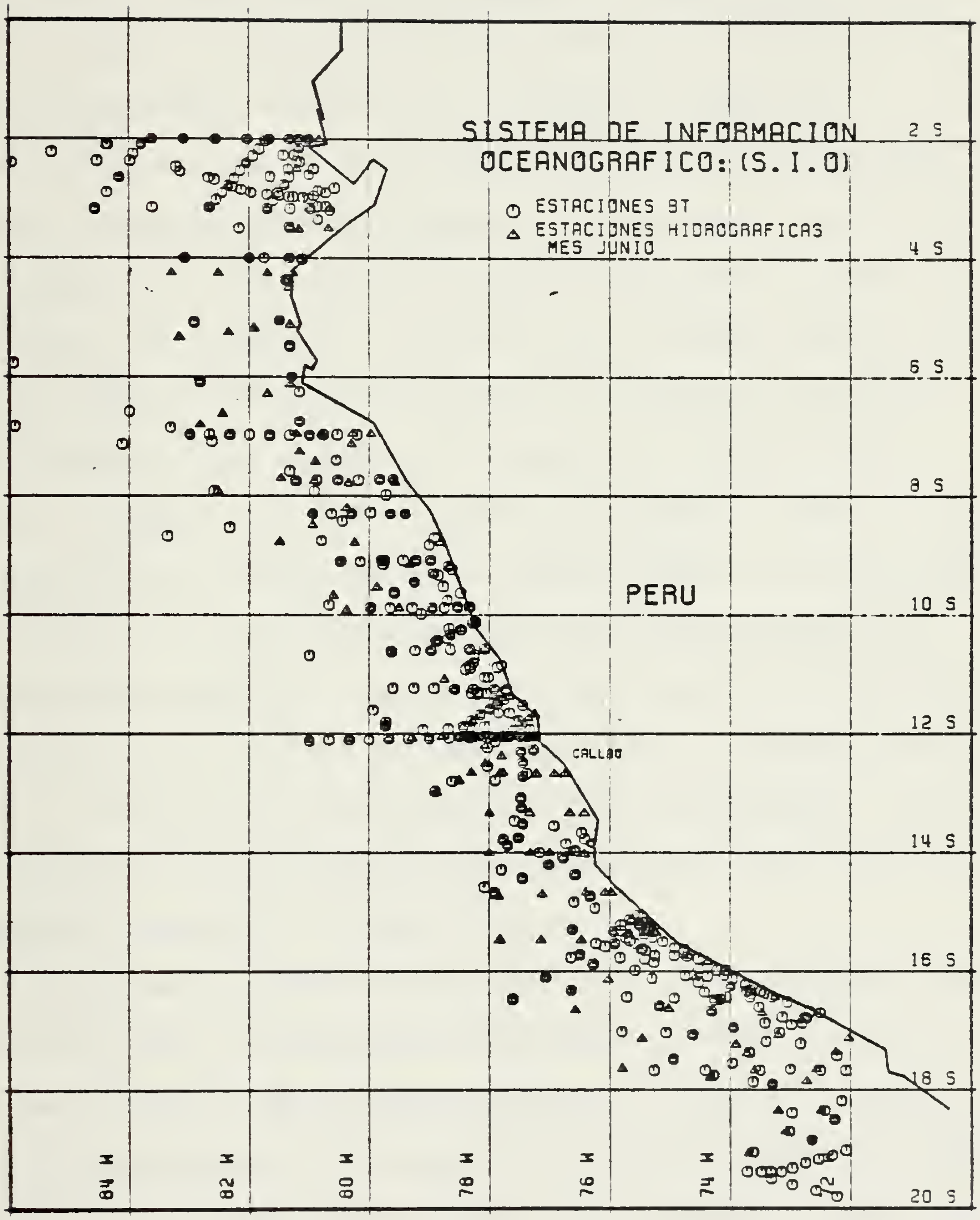


FIGURE 7: Hydrocast and Historical BT Data for the Month of June, All Years

C. NAVAL APPLICATIONS

Two of the purposes of the organization of the SIO are to provide the Peruvian Navy the capability of obtaining oceanographic data for analysis and to provide operational products for naval applications. Some of the practical applications derived from the processing of historical oceanographic information for the Navy have been tested for several years, and some of these have been implemented as operational products in many navies. Some examples of these products are those used in navigation aids, environmental forecasts, and acoustic analyses. In this section, one example of an application for the Navy using the SIO that can readily provide a useful operational product will be given. The discussion of this example is the subject of another NPS thesis [Garcia, 1981] that used data selected directly from this bank.

The acoustical characteristics of the water masses in a naval operation area are of vital importance when planning and executing submarine and ASW operations. Although the fleet normally acquires BT's during operations to analyze the thermal structure of the ocean, information is needed prior to the operation for planning purposes. Historical data can be used to analyze the ocean conditions statistically by geographical quadrangles and time of the year.

To determine the acoustic characteristics of the water masses along the coast of Peru, the geographical area between 0° and 20° S and 70° to 86° W was divided into 83 one-degree quadrangles (Figure 8). The details of the selection of the areas as well as the analysis of the data for each area is given in Garcia (1981). As an example, an analysis of one of the sections will be summarized here. To study the acoustical

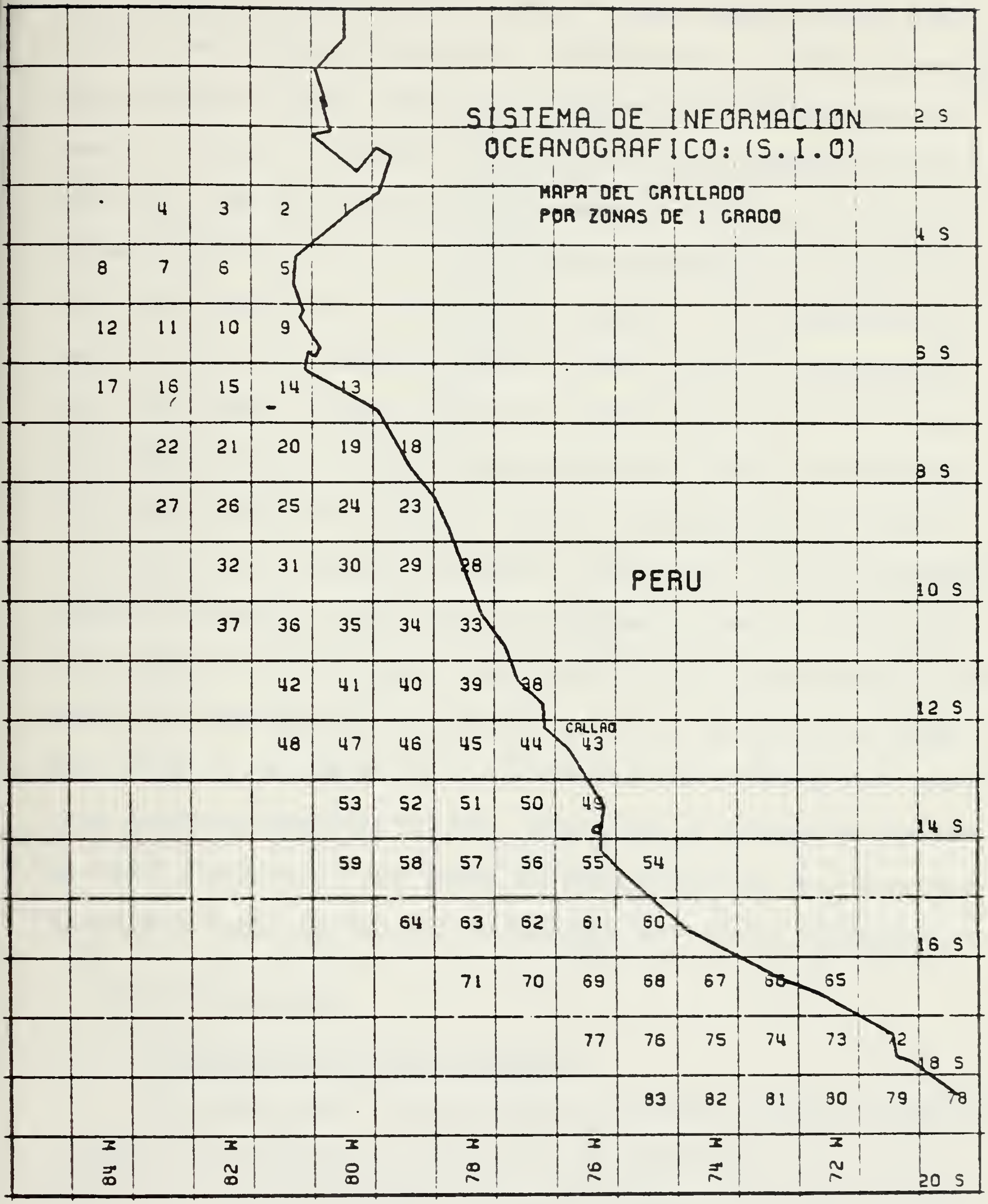


FIGURE 8: Map with Grid of One Degree Quadrangles

effects of a water mass in each of the areas, the available historical data were used to obtain monthly graphs of sound speed profiles. These profiles were grouped by quarters: Jan-Mar, Apr-Jun, Jul-Sep and Oct-Dec. They were then plotted separately for each one-degree quadrangle and quarter. (Figure 9 represents all the profiles from quadrangle #60 for Apr-Jun). From each of the quarterly groups of profiles, one or more curves were selected as the ones that best represented the characteristic of the water mass for that area and quarter. This selected profile was then input to an acoustical model to obtain curves of transmission loss versus range. Figure 10 shows the transmission loss curves for 6 frequencies (50, 100, 200, 300, 500 and 800 hertz) using the representative sound speed profile for April-June for quadrangle #60 of Figure 9. In this particular example, the acoustic model used is the Fast Asymptotic Coherent Transmission Model (FACT), implemented at the W. R. Church Computer Center at the NPS. The transmission loss curves from the FACT model provides detection ranges for specific sonar characteristics of a given ship. This is strategically vital information when planning naval operations involving submarines and ASW. Other kinds of information that can be readily obtained and also useful for ASW applications include surface temperature charts and charts of the average depth of the thermocline.

D. OTHER APPLICATIONS

1. Topography of Isothermal Surfaces

In recent years, many new theories and models have been developed to predict and simulate the onset of "El Nino" [Hurlburt et al., 1976; Wyrtki, 1975; Bjerknes, 1961]. The data acquired by the CUEA experiments

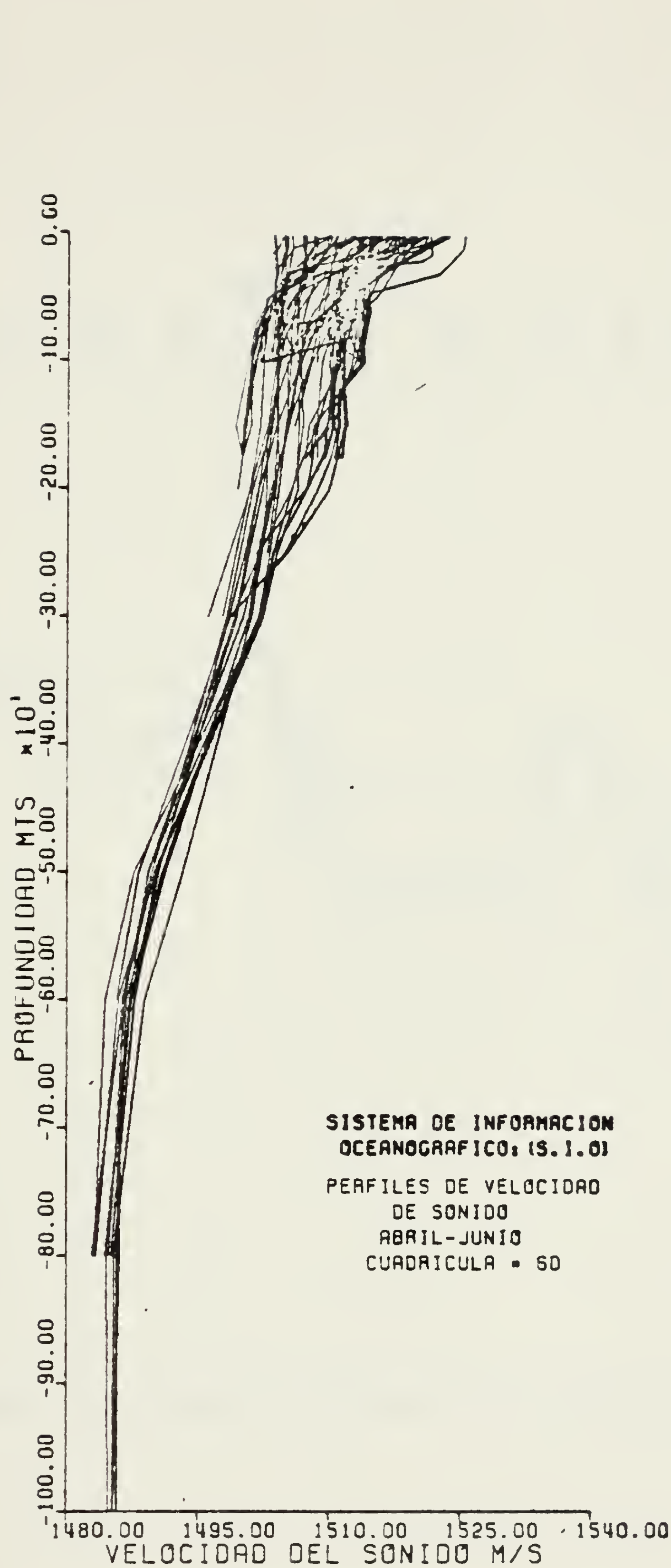


FIGURE 9: Sound Speed Profiles for Period April-June Quadrangle #60

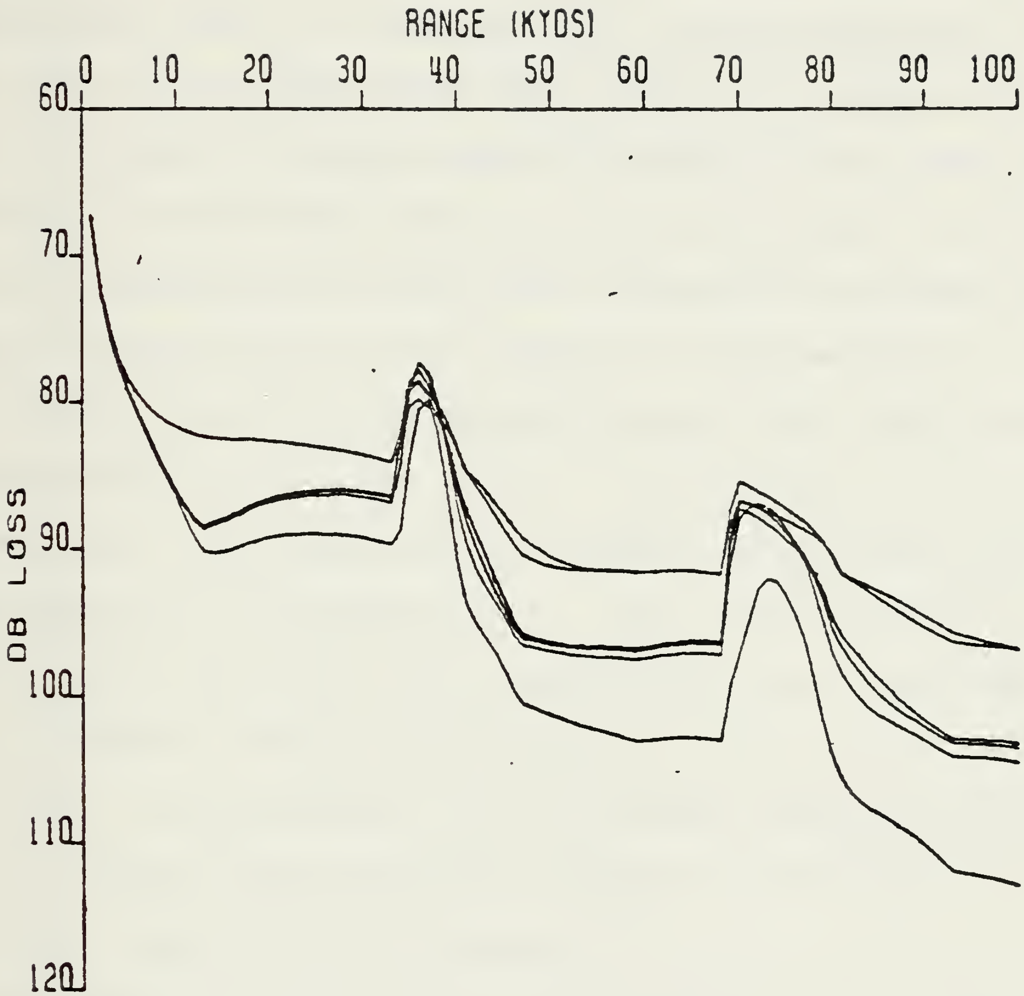


FIGURE 10: Trans. Loss Curves for Representative Profile at 6 Frequencies

and others in the Pacific during the last decade have been analyzed in light of the new theories with very interesting results. Wurtki (1975) suggested an explanation for "El Nino": strong southeast trade winds over the Eastern Pacific produce an east-west slope of sea level and an accumulation of water in the western Pacific. When the south-east trade winds relax, the accumulated water moves eastward as an equatorial internal Kelvin wave. Wyrtki found good correlation between "El Nino" years and weakening of the south-east trade winds in the previous year. As a result of the weakening of the trade winds, warm water from the west flows toward the northern coast of Peru, depressing of the thermocline. The effect of the depression of the thermocline can be clearly seen by mapping the topography of an isothermal surface. The 15°C isotherm in the area off Peru lies in the thermocline and intersects the sea surface during strong upwelling in the Southern winter. Thus, the 15°C isotherm is a good indicator of the depth of the thermocline and can be used to map areas of upwelling. Based on published cruise reports, Wyrtki (1975) presented maps of the topography of the 15°C isotherm surface during several months in 1972 and showed progressive deepening of the surface as a result of the strong "El Nino" in that year.

Climatological data can be used to map topography of an isothermal surface and, thus, to determine the variability of the depth of the thermocline. Figure 11 shows the depth of the 15°C isotherm computed from the SIO for data acquired in May 1971. If sufficient data are available, a sequence of maps can be obtained to show the variation of the depth of the thermocline and of areas of upwelling.

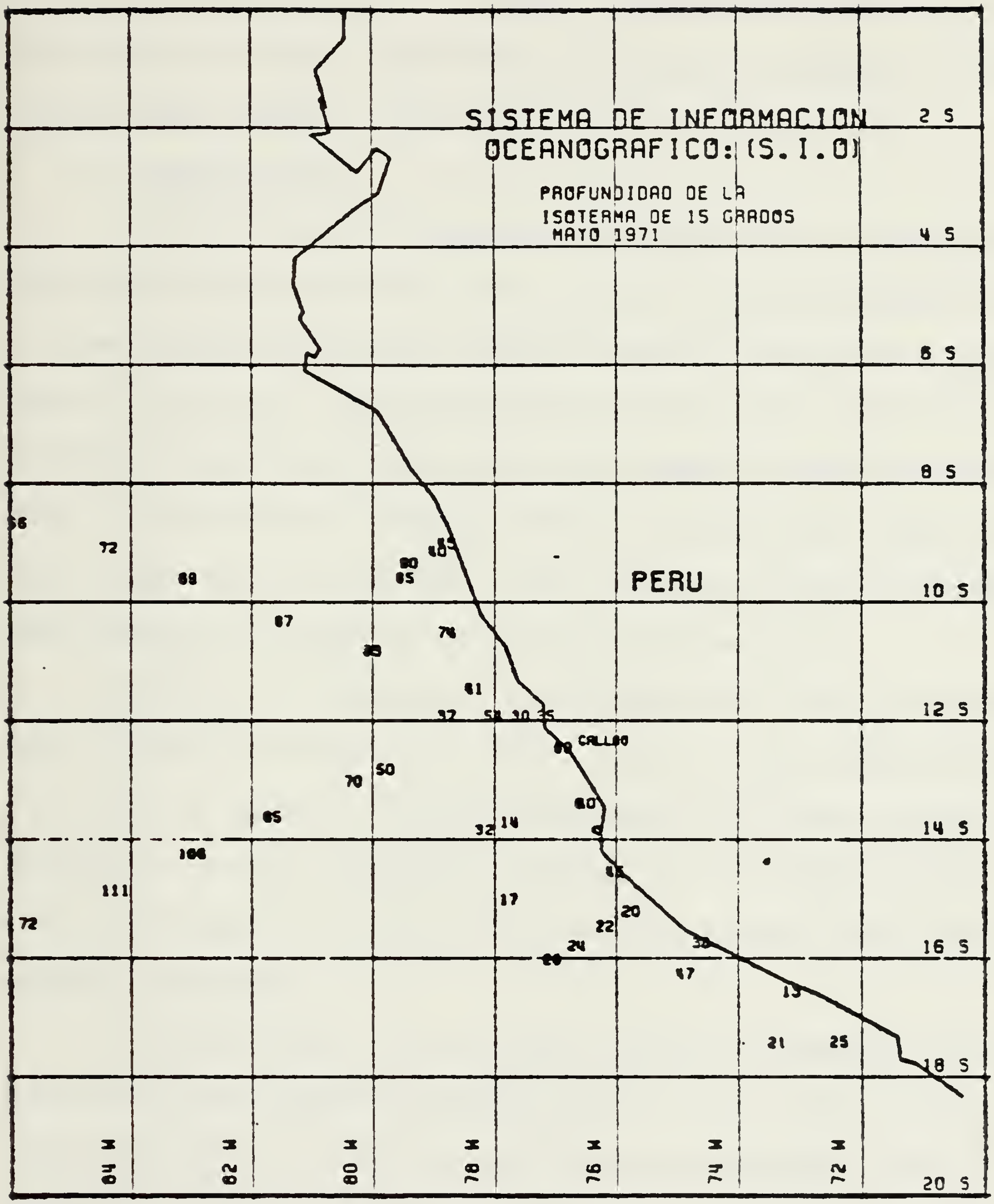


FIGURE 11: Map of Depth(m) of 15 C Isotherm for May 1971

The fluctuation of the depth of other isothermal surfaces have also been analyzed for similar studies. For example, the annual variation of the slope of the 14°C isotherm along the equator has been correlated with wind stress values to study the eastward propagation of energy in this region [Meyers, 1979].

2. Sea Level Data

Sea level data, as recorded by the DHNM at six tide gauge stations along the coast of Peru, will be part of the SIO as shown in Table 2. The recording and study of sea level and its fluctuations have been done for centuries. The ancient Greeks were the first to record the relationship between the tides and the moon's monthly passage around the earth. It was not until Newton presented his gravitational theory that this relationship was explained. Since then, many different techniques have been used for recording and predicting the sea level.

Because of its importance to navigation and its ease of measurement, sea level is now widely recorded. Historical sea level data exists for periods of decades or longer at many coastal and island locations worldwide. Sea level fluctuations have been closely studied recently, to study low frequency fluctuations resulting from various oceanic and atmospheric processes.

Along the coast of Peru, several studies have recently correlated winds and surface temperature changes with sea level changes. The results indicated the presence of low frequency perturbations traveling poleward as coastally trapped baroclinic waves (internal Kelvin waves) [Smith, 1978; Enfield and Allen, 1970]. These waves seem to play an important role in the propagation of an "El Nino".

VI. CONCLUSIONS

Large amounts of data have been acquired along the coast of Peru for many years. Some of these data have already been assembled by large oceanographic data centers like NODC, World Data Center, and Fleet Numerical Oceanography Center. However, there are still some historical data that have not been incorporated in those data banks and can be found only in the archives of the original sources.

A large proportion of the oceanographic data acquired along the Peruvian coast, particularly during the last decade, was obtained under international cooperative programs and experiments. Most of the information obtained by the international programs and by Peruvian Institutions is generally available. However, no Peruvian agency or institution was assigned the responsibility of assembling all available data acquired during those programs.

In order to improve the understanding of the effects of currents along the coast of Peru as well as the "El Nino" event, it is important to organize an oceanographic data bank in Peru. Most of the historical data required for such a bank are available from large international oceanographic data centers and from Peruvian and foreign institutions. Unfortunately, some of the latter information is not in a computer accessible form. Also, some of the data that are in computer accessible form are stored in non-standard formats, making the merging of all the available data difficult.

The Peruvian Navy, as one of the institutions that acquires oceanographic data on a continuing basis, was recently assigned the responsibility of organizing an oceanographic data bank for Peru. The first step in the organization of the data bank was to compile, from several sources, all the readily available historical data from the coastal waters of Peru. The next and most important step will be the establishment of procedures to update the data bank on a continuing basis. This will involve monitoring ocean conditions and exchanging data with other institutions. This program will have to be done in cooperation with local institutions such as fisheries as well as regional and international organizations under a data exchange agreement. The last step in the organization of the data bank will fulfill its mission: the implementation of computer programs and application products to provide a variety of data analysis services to users.

APPENDIX A

FORMAT OF HYDROCAST PROFILE

```
REPORTE NRO    613          GRUPO FECHA HORA =   65012116
CODIGO DE LLAMADA DEL BUQUE =  00061EX   TIPO DE DATA= 4
    POSICION :  LAT =-18.50   LONG =-72.38
NIVELES = 13
```

PROF.	TEMP.	SAL.	VEL.SON	OXG.
0.0	25.01	34.93	1534.80	5.40
10.00	24.77	35.33	1534.80	5.00
20.00	20.02	35.00	1522.50	6.00
30.00	18.20	34.94	1517.50	6.20
50.00	15.68	34.85	1509.20	4.50
74.00	13.36	34.87	1503.10	4.70
99.00	12.95	34.97	1502.30	0.70
199.00	11.85	34.95	1500.10	0.30
297.00	10.77	34.89	1497.90	0.70
397.00	9.62	34.79	1495.20	0.30
496.00	8.14	34.69	1491.20	0.60
794.00	5.77	34.62	1486.60	1.00
992.00	4.87	34.61	1486.30	1.50

FORMAT OF BT PROFILES

```
REPORTE NRO    6592         GRUPO FECHA HORA =   62063006
CODIGO DE LLAMADA DEL BUQUE =    14524   TIPO DE DATA= 3
    POSICION :  LAT =-12.78   LONG =-77.90
NIVELES = 11
```

PRO.	TEMP.	PROF.	TEMP.	PROF.	TEMP.
0.0	27.03	10.00	25.73	20.00	21.97
30.00	17.65	55.00	15.72	70.00	13.31
95.00	11.07	180.00	10.05	220.00	8.40
270.00	7.80	300.00	7.15		

LIST OF OBSERVATIONS - YEAR 1960

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ARCHIVO ANO 1960

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NRO	GR.FECHA	COD.BUQ	LAT	LONG	T	H
603	60012118	03513	-17.10	-85.88	3	18
604	60012119	03513	-17.28	-85.73	3	19
605	60012121	03513	-17.63	-85.43	3	21
606	60012122	03513	-17.82	-85.28	3	22
607	60012123	03513	-17.98	-85.13	3	23
657	60012200	03513	-18.17	-84.98	3	0
658	60012201	03513	-18.35	-84.83	3	1
659	60012202	03513	-18.53	-84.68	3	2
660	60012203	03513	-18.73	-84.55	3	3
661	60012204	03513	-18.92	-84.40	3	4
686	60012207	03513	-19.50	-83.95	3	7
687	60012207	03513	-19.50	-83.95	3	7
688	60012208	03513	-19.68	-83.80	3	8
689	60012209	03513	-19.87	-83.65	3	9
690	60012205	03513	-19.12	-84.25	3	5
691	60012206	03513	-19.30	-84.10	3	6
3660	60033005	03512	-16.90	-73.30	3	53
3661	60033008	066601BI	-16.35	-73.58	4	8
3662	60033010	066601BI	-16.27	-73.67	4	10
3663	60033011	03512	-16.48	-73.43	3	113
3664	60033012	03512	-16.53	-73.93	3	12
3691	60033012	03512	-16.60	-74.00	3	123
3692	60033013	03512	-16.68	-74.07	3	13
3693	60033013	03512	-16.77	-74.15	3	133
3694	60033014	03512	-16.85	-74.20	3	14
3695	60033014	03512	-16.93	-74.27	3	143
3747	60033000	03512	-17.93	-72.97	3	03
3748	60033001	03512	-17.82	-73.00	3	1
3749	60033001	03512	-17.73	-73.03	3	13
3750	60033002	03512	-17.62	-73.05	3	2
3751	60033002	03512	-17.52	-73.08	3	23
3752	60033003	03512	-17.42	-73.12	3	3
3753	60033004	03512	-17.20	-73.18	3	4
3754	60033004	03512	-17.10	-73.23	3	43
3762	60033015	066601BI	-17.00	-74.33	4	15
3763	60033015	03512	-17.00	-74.33	3	151
3764	60033019	03512	-17.12	-74.42	3	193
3765	60033020	03512	-17.27	-74.57	3	203
3766	60033021	03512	-17.35	-74.63	3	21
3767	60033021	03512	-17.45	-74.72	3	213
3768	60033022	03512	-17.52	-74.78	3	22
3769	60033022	03512	-17.60	-74.87	3	223
3770	60033023	066601BI	-17.63	-74.88	4	23
3771	60033023	03512	-17.63	-74.88	3	231
3772	60033102	03512	-17.75	-74.98	3	23
3778	60033103	03512	-17.82	-75.05	3	3
3779	60033103	03512	-17.88	-75.10	3	33
3780	60033104	03512	-17.95	-75.17	3	4
3789	60033123	03512	-17.97	-77.15	3	23

3790	60033123	03512	-17.90	-77.23	3	233
3803	60032920	03512	-18.35	-72.12	3	20
3804	60032920	03512	-18.33	-72.23	3	203
3805	60032921	03512	-18.33	-72.37	3	21
3806	60032921	03512	-18.32	-72.48	3	213
3807	60032922	03512	-18.32	-72.60	3	22
3808	60032923	03512	-18.23	-72.82	3	23
3809	60032923	03512	-18.13	-72.87	3	233
3810	60033000	03512	-18.03	-72.93	3	0
3845	60033104	03512	-18.03	-75.23	3	43
3846	60033105	03512	-18.10	-75.28	3	5
3847	60033105	03512	-18.10	-75.28	3	5
3848	60033106	06601BI	-18.25	-75.42	4	6
3849	60033106	03512	-18.25	-75.42	3	62
3850	60033110	03512	-18.40	-75.55	3	10
3851	60033110	03512	-18.48	-75.62	3	103
3852	60033111	03512	-18.55	-75.68	3	11
3853	60033111	03512	-18.63	-75.75	3	113
3854	60033112	03512	-18.72	-75.82	3	12
3855	60033112	03512	-18.80	-75.88	3	123
3856	60033113	03512	-18.87	-75.95	3	13
3861	60033113	03512	-18.95	-76.02	3	135
3862	60033114	06601BI	-18.95	-76.02	4	14
3863	60033117	03512	-18.80	-76.20	3	173
3864	60033118	03512	-18.72	-76.28	3	18
3865	60033118	03512	-18.65	-76.37	3	183
3866	60033119	03512	-18.57	-76.47	3	19
3867	60033119	03512	-18.50	-76.55	3	193
3868	60033120	03512	-18.42	-76.63	3	20
3869	60033120	03512	-18.35	-76.72	3	203
3870	60033121	03512	-18.27	-76.80	3	21
3871	60033121	03512	-18.18	-76.88	3	213
3872	60033122	03512	-18.12	-76.98	3	22
3876	60033122	03512	-18.05	-77.07	3	223
3884	60032604	03512	-19.95	-72.73	3	43
3885	60032605	03512	-19.87	-72.63	3	5
3886	60032605	03512	-19.80	-72.53	3	53
3887	60032606	03512	-19.73	-72.45	3	6
3888	60032606	03512	-19.73	-72.45	3	6
3889	60032607	06601BI	-19.62	-72.30	4	7
3890	60032607	03512	-19.62	-72.30	3	71
3891	60032610	03512	-19.50	-72.17	3	103
3892	60032611	03512	-19.43	-72.10	3	11
3989	60041609	03513	-2.90	-85.55	3	9
3990	60041610	03513	-2.73	-85.47	3	10
3991	60041611	03513	-2.55	-85.37	3	11
3992	60041612	03513	-2.38	-85.27	3	12
3993	60041613	03513	-2.18	-85.17	3	13
4049	60041605	03513	-3.62	-85.90	3	5
4050	60041606	03513	-3.45	-85.82	3	6
4051	60041607	03513	-3.27	-85.73	3	7
4052	60041608	03513	-3.08	-85.65	3	8
4083	60041410	03512	-4.72	-81.92	3	103
4084	60041411	03512	-4.70	-81.82	3	11
4085	60041411	03512	-4.70	-81.72	3	113
4086	60041412	03512	-4.70	-81.62	3	12
4087	60041412	03512	-4.68	-81.52	3	123
4088	60041413	06601BI	-4.68	-81.38	4	13
4089	60041414	06601BI	-4.67	-81.38	4	14
4090	60041416	03512	-4.63	-81.82	3	163
4108	60041404	03512	-4.90	-82.38	3	43
4109	60041405	06601BI	-4.73	-82.42	4	5
4110	60041405	03512	-4.78	-82.40	3	5
4111	60041405	03512	-4.73	-82.42	3	54
4112	60041408	03512	-4.73	-82.30	3	83
4113	60041409	03512	-4.73	-82.22	3	9
4114	60041409	03512	-4.73	-82.12	3	93

4115	60041410	03512	-4.72	-82.02	3	10
4118	60041422	03512	-4.57	-83.17	3	223
4119	60041500	03512	-4.55	-83.50	3	0
4120	60041500	03512	-4.55	-83.57	3	04
4121	60041501	06601BI	-4.55	-83.57	4	1
4127	60041504	03512	-4.55	-84.02	3	43
4128	60041505	03512	-4.55	-84.12	3	5
4129	60041506	03512	-4.57	-84.45	3	63
4130	60041507	06601BI	-4.58	-84.53	4	7
4131	60041507	03512	-4.57	-84.35	3	7
4132	60041507	03512	-4.57	-84.53	3	72
4133	60041510	03512	-4.58	-84.62	3	10
4134	60041510	03512	-4.58	-84.72	3	103
4135	60041511	03512	-4.58	-84.80	3	11
4136	60041511	03512	-4.58	-84.90	3	113
4137	60041512	03512	-4.60	-84.98	3	12
4138	60041512	03512	-4.60	-85.08	3	123
4139	60041513	03512	-4.60	-85.18	3	13
4142	60041514	06601BI	-4.62	-85.35	4	14
4143	60041514	03512	-4.62	-85.35	3	142
4144	60041517	03512	-4.62	-85.53	3	173
4145	60041518	03512	-4.62	-85.65	3	18
4146	60041518	03512	-4.60	-85.77	3	183
4147	60041519	03512	-4.60	-85.88	3	19
4148	60041519	03512	-4.60	-85.98	3	193
4191	60041320	03512	-5.97	-82.40	3	20
4192	60041320	03512	-5.92	-82.33	3	203
4193	60041321	03512	-5.87	-82.23	3	21
4194	60041321	03512	-5.83	-82.17	3	215
4195	60041322	06601BI	-5.83	-82.17	4	22
4196	60041402	03512	-5.45	-82.25	3	2
4197	60041402	03512	-5.33	-82.28	3	23
4198	60041403	03512	-5.22	-82.30	3	3
4201	60041403	03512	-5.12	-82.33	3	33
4202	60041404	03512	-5.00	-82.35	3	4
4231	60041118	06601BI	-6.90	-80.77	4	18
4232	60041119	06601BI	-6.93	-80.92	4	19
4260	60041314	03512	-6.37	-82.97	3	14
4261	60041314	03512	-6.28	-82.88	3	143
4262	60041315	06601BI	-6.13	-82.73	4	15
4263	60041315	03512	-6.20	-82.80	3	15
4264	60041315	03512	-6.15	-82.73	3	155
4265	60041319	03512	-6.07	-82.55	3	19
4266	60041319	03512	-6.02	-82.48	3	193
4272	60041306	03512	-6.97	-83.72	3	63
4273	60041307	03512	-6.90	-83.63	3	7
4274	60041307	03512	-6.83	-83.53	3	73
4275	60041308	06601BI	-6.75	-83.42	4	8
4276	60041308	03512	-6.75	-83.42	3	84
4277	60041312	03512	-6.62	-83.25	3	123
4278	60041313	03512	-6.53	-83.17	3	13
4279	60041313	03512	-6.45	-83.07	3	133
4314	60041120	03512	-7.02	-81.87	3	203
4315	60041121	03512	-7.07	-81.17	3	21
4316	60041121	03512	-7.10	-81.25	3	213
4317	60041122	03512	-7.15	-81.33	3	22
4318	60041122	03512	-7.18	-81.42	3	223
4319	60041123	06601BI	-7.22	-81.48	4	23
4320	60041123	03512	-7.22	-81.48	3	232
4321	60041203	03512	-7.25	-81.58	3	3
4322	60041203	03512	-7.30	-81.68	3	33
4323	60041204	03512	-7.33	-81.78	3	4
4324	60041204	03512	-7.38	-81.90	3	43
4330	60041205	03512	-7.42	-82.02	3	5
4331	60041205	03512	-7.45	-82.12	3	53
4332	60041206	06601BI	-7.50	-82.25	4	6
4333	60041206	03512	-7.50	-82.23	3	63

4334	60041209	03512	-7.55	-82.38	3	93
4335	60041210	03512	-7.58	-82.48	3	10
4336	60041210	03512	-7.62	-82.58	3	103
4337	60041211	03512	-7.65	-82.68	3	11
4338	60041211	03512	-7.68	-82.78	3	113
4339	60041212	03512	-7.72	-82.88	3	12
4343	60041212	03512	-7.75	-83.00	3	123
4344	60041213	06601BI	-7.75	-83.00	4	13
4345	60041213	03512	-7.75	-83.00	3	13
4346	60041216	03512	-7.82	-83.13	3	16
4347	60041216	03512	-7.83	-83.25	3	163
4348	60041217	03512	-7.88	-83.35	3	17
4349	60041217	03512	-7.92	-83.45	3	173
4350	60041218	03512	-7.95	-83.57	3	18
4351	60041222	03512	-7.92	-83.78	3	22
4352	60041223	03512	-7.75	-83.93	3	23
4353	60041305	03512	-7.10	-83.90	3	53
4354	60041306	03512	-7.03	-83.82	3	6
4357	60041223	03512	-7.67	-84.00	3	233
4358	60041300	03512	-7.57	-84.08	3	0
4359	60041300	03512	-7.50	-84.15	3	03
4360	60041301	03512	-7.38	-84.15	3	1
4361	60041301	03512	-7.28	-84.15	3	15
4362	60041302	06601BI	-7.28	-84.15	4	2
4363	60041305	03512	-7.17	-84.00	3	5
4391	60041109	03512	-8.90	-80.00	3	9
4392	60041110	03512	-8.67	-80.08	3	10
4408	60041219	06601BI	-8.00	-83.72	4	19
4409	60041219	03512	-8.00	-83.70	3	191
4434	60041107	03512	-9.28	-79.67	3	7
4435	60041108	03512	-9.12	-79.83	3	8
4482	60041023	03512	-10.68	-78.43	3	23
4483	60041100	03512	-10.50	-78.57	3	0
4582	60041021	03512	-11.03	-78.17	3	21
4643	60040323	03512	-12.95	-77.52	3	23
4644	60040400	03512	-12.88	-77.52	3	0
4645	60040401	03512	-12.78	-77.52	3	1
4646	60040402	03512	-12.78	-77.67	3	2
4647	60040403	03512	-12.78	-77.83	3	3
4835	60040318	03512	-13.90	-77.65	3	18
4836	60040319	03512	-13.72	-77.63	3	19
4837	60040320	03512	-13.52	-77.60	3	20
4838	60040321	03512	-13.32	-77.57	3	21
4839	60040322	03512	-13.12	-77.55	3	22
4913	60040313	03512	-14.85	-77.77	3	13
4914	60040314	03512	-14.63	-77.75	3	14
4915	60040315	03512	-14.48	-77.72	3	15
4916	60040316	03512	-14.28	-77.70	3	16
4917	60040317	03512	-14.08	-77.67	3	17
4938	60040120	03512	-15.92	-75.67	3	20
4939	60040122	03512	-15.55	-75.28	3	223
4940	60040123	06601BI	-15.40	-75.15	4	23
4941	60040201	06601BI	-15.43	-75.18	4	1
4942	60040201	03512	-15.50	-75.27	3	13
4943	60040202	03512	-15.58	-75.35	3	2
4944	60040203	03512	-15.78	-75.58	3	33
4945	60040204	03512	-15.87	-75.67	3	4
4946	60040209	03512	-15.95	-75.95	3	9
5014	60040209	03512	-15.90	-76.03	3	93
5015	60040210	03512	-15.83	-76.10	3	10
5016	60040212	03512	-15.77	-76.18	3	123
5017	60040213	06601BI	-15.78	-76.18	4	13
5033	60040301	03512	-15.98	-77.33	3	1
5034	60040302	03512	-15.90	-77.53	3	2
5035	60040302	03512	-15.85	-77.63	3	23
5036	60040303	03512	-15.80	-77.73	3	3
5037	60040303	03512	-15.75	-77.83	3	33

5038	60040306	06601BI	-15.70	-77.95	4	6
5039	60040306	03512	-15.70	-77.93	3	62
5040	60040310	03512	-15.45	-77.87	3	10
5041	60040311	03512	-15.23	-77.82	3	11
5042	60040312	03512	-15.05	-77.80	3	12
5065	60040118	03512	-16.23	-75.98	3	18
5066	60040118	03512	-16.15	-75.90	3	183
5067	60040119	03512	-16.08	-75.82	3	19
5068	60040119	03512	-16.00	-75.75	3	193
5069	60040205	06601BI	-16.03	-75.88	4	5
5076	60040111	03512	-16.92	-76.68	3	11
5077	60040111	03512	-16.83	-76.58	3	113
5078	60040112	03512	-16.73	-76.50	3	12
5079	60040112	03512	-16.65	-76.40	3	123
5080	60040113	06601BI	-16.60	-76.35	4	13
5081	60040113	03512	-16.58	-76.35	3	132
5082	60040116	03512	-16.53	-76.28	3	16
5083	60040218	03512	-16.02	-76.85	3	183
5084	60040219	03512	-16.03	-76.93	3	19
5088	60040219	03512	-16.07	-77.02	3	193
5089	60040222	06601BI	-16.10	-77.10	4	22
5090	60040222	03512	-16.10	-77.12	3	22
5121	60040107	06601BI	-17.20	-76.97	4	7
5122	60040107	03512	-17.20	-76.97	3	71
5123	60040110	03512	-17.00	-76.77	3	103
5127	60040100	03512	-17.75	-77.42	3	03
5128	60040101	06601BI	-17.70	-77.47	4	1
5129	60040101	03512	-17.72	-77.47	3	12
5130	60040104	03512	-17.55	-77.32	3	43
5131	60040105	03512	-17.48	-77.23	3	5
5132	60040105	03512	-17.40	-77.15	3	53
5133	60040106	03512	-17.32	-77.08	3	6
5134	60040106	03512	-17.23	-77.00	3	63
9365	60092013	03923	-2.08	-81.25	3	13
9366	60092023	03923	-2.10	-81.33	3	23
9367	60092119	03923	-2.17	-81.17	3	193
9368	60092223	03922	-2.18	-81.32	3	235
9369	60092303	03922	-2.02	-81.60	3	35
9370	60092311	03922	-2.07	-81.57	3	113
9371	60092313	03922	-2.22	-81.78	3	134
9372	60092400	03922	-2.35	-81.80	3	01
9373	60092412	03924	-2.25	-81.52	3	12
9374	60092412	03925	-2.02	-81.37	3	12
9375	60092715	03923	-2.72	-81.20	3	15
9386	60092316	03922	-2.30	-82.02	3	162
9387	60093021	13406	-2.22	-82.38	3	21
9388	60093022	13406	-2.42	-82.38	3	223
9390	60092801	13406	-2.10	-84.12	3	13
9391	60092902	08761HO	-2.10	-84.23	4	24
9392	60092904	13406	-2.08	-84.12	3	43
9412	60092719	03923	-3.67	-81.33	3	19
9413	60092721	03922	-3.88	-81.40	3	213
9456	60092800	03923	-4.50	-81.50	3	0
9457	60092800	03924	-4.50	-81.50	3	0
9493	60092800	03925	-4.42	-82.45	3	0
9536	60092803	03923	-5.43	-81.42	3	3
9611	60092808	03923	-6.37	-81.18	3	8
9685	60092812	03922	-7.27	-80.70	3	12
9686	60092812	03924	-7.22	-80.75	3	12
9687	60092812	03925	-7.03	-80.70	3	12
9688	60092813	03923	-7.43	-80.58	3	13
9758	60092820	03925	-8.88	-79.63	3	20
9960	60092900	03925	-9.73	-79.10	3	0
10038	60092904	03925	-10.77	-78.40	3	4
10148	60092908	03925	-11.67	-77.82	3	8
10255	60093014	03923	-12.23	-77.45	3	14
10256	60093018	03924	-12.30	-77.33	3	183

10891	60100310	13406	-2.95	-80.92	3	10
10892	60100310	08761HO	-2.95	-80.92	4	101
10901	60100103	13406	-2.10	-81.97	3	3
10902	60100201	13406	-2.02	-81.82	3	13
10903	60100301	13406	-2.30	-81.88	3	1
10904	60100302	13406	-2.40	-81.73	3	2
10905	60100302	13406	-2.47	-81.62	3	25
10906	60100303	08761HO	-2.47	-81.62	4	31
10907	60100305	13406	-2.53	-81.52	3	5
10908	60100306	13406	-2.68	-81.28	3	62
10909	60100306	08761HO	-2.68	-81.28	4	64
10910	60100308	13406	-2.72	-81.23	3	8
10911	60100309	13406	-2.82	-81.10	3	9
10912	60100416	13406	-2.87	-81.90	3	16
10913	60100417	13406	-2.87	-81.75	3	17
10914	60100418	13406	-2.87	-81.60	3	18
10936	60100100	13406	-2.42	-82.28	3	0
10937	60100101	13406	-2.25	-82.12	3	13
10938	60100203	13406	-2.22	-82.00	3	3
10939	60100203	08761HO	-2.22	-82.00	4	33
10941	60100300	13406	-2.22	-82.00	3	0
10942	60100412	13406	-2.98	-82.38	3	12
10943	60100413	13406	-2.87	-82.32	3	13
10944	60100414	13406	-2.87	-82.20	3	14
10945	60100415	13406	-2.87	-82.05	3	15
10984	60100312	13406	-3.03	-80.78	3	12
10985	60100312	08761HO	-3.03	-80.78	4	121
10986	60100314	13406	-3.13	-80.63	3	14
10987	60100314	13406	-3.18	-80.55	3	143
10988	60100314	08761HO	-3.18	-80.55	4	144
10989	60100316	13406	-3.25	-80.67	3	16
10990	60100317	13406	-3.33	-80.80	3	17
10991	60100318	13406	-3.42	-80.95	3	18
11011	60100319	13406	-3.53	-81.10	3	19
11012	60100320	13406	-3.65	-81.27	3	20
11013	60100321	13406	-3.77	-81.42	3	21
11014	60100322	13406	-3.85	-81.55	3	22
11015	60100323	13406	-3.95	-81.70	3	23
11016	60100419	13406	-3.00	-81.60	3	19
11017	60100420	13406	-3.12	-81.60	3	20
11018	60100421	13406	-3.27	-81.60	3	21
11019	60100422	13406	-3.35	-81.73	3	22
11020	60100423	13406	-3.43	-81.87	3	23
11041	60100407	13406	-3.80	-82.38	3	7
11042	60100408	13406	-3.63	-82.38	3	8
11043	60100409	13406	-3.47	-82.38	3	9
11044	60100410	13406	-3.32	-82.38	3	10
11045	60100411	13406	-3.15	-82.38	3	11
11046	60100500	13406	-3.53	-82.02	3	0
11047	60100501	13406	-3.62	-82.15	3	1
11048	60100502	13406	-3.68	-82.27	3	2
11049	60100503	13406	-3.87	-82.13	3	3
11050	60100504	13406	-3.90	-82.00	3	4
11071	60100400	13406	-4.07	-81.85	3	0
11072	60100401	13406	-4.13	-81.98	3	1
11073	60100505	13406	-4.00	-81.88	3	5
11074	60100506	13406	-4.10	-81.77	3	6
11075	60100507	13406	-4.20	-81.65	3	7
11076	60100508	13406	-4.32	-81.52	3	8
11077	60100509	13406	-4.42	-81.38	3	9
11078	60100612	13406	-4.92	-81.37	3	123
11087	60100402	13406	-4.22	-82.08	3	2
11088	60100403	13406	-4.30	-82.30	3	3
11089	60100404	13406	-4.30	-82.38	3	4
11090	60100405	13406	-4.13	-82.38	3	5
11096	60100614	13406	-5.18	-81.35	3	14
11097	60100615	13406	-5.43	-81.35	3	153

11098	60100617	13406	-5.70	-81.32	3	17
11099	60100618	13406	-5.95	-81.30	3	183
11121	60100620	13406	-6.03	-81.30	3	202
11122	60100812	13406	-6.03	-81.30	3	125
11123	60100813	08761HO	-6.03	-81.30	4	133
11124	60100820	13406	-6.12	-81.57	3	20
11125	60100821	13406	-6.23	-81.73	3	21
11126	60100822	13406	-6.33	-81.83	3	22
11127	60100822	13406	-6.38	-81.90	3	223
11128	60100823	08761HO	-6.38	-81.90	4	232
11144	60100905	13406	-6.50	-82.10	3	5
11145	60100906	13406	-6.60	-82.23	3	6
11146	60100907	13406	-6.72	-82.45	3	72
11147	60100908	08761HO	-6.72	-82.45	4	8
11148	60100915	13406	-6.82	-82.60	3	15
11149	60100916	13406	-6.92	-82.73	3	16
11222	60100918	13406	-7.03	-82.93	3	183
11223	60100919	08761HO	-7.03	-82.93	4	191
11224	60100921	13406	-7.08	-83.00	3	21
11225	60100922	13406	-7.17	-83.15	3	22
11226	60100923	13406	-7.25	-83.30	3	23
11227	60101000	13406	-7.33	-83.45	3	0
11228	60101001	13406	-7.42	-83.60	3	1
11229	60101002	13406	-7.50	-83.75	3	2
11230	60101002	13406	-7.53	-83.80	3	23
11231	60101003	08761HO	-7.53	-83.80	4	31
11232	60101010	13406	-7.60	-83.93	3	10
11233	60101011	13406	-7.70	-84.08	3	11
11234	60101012	13406	-7.77	-84.23	3	12
11235	60101013	13406	-7.85	-84.38	3	132
11236	60101014	13406	-7.93	-84.55	3	14
11311	60101015	13406	-8.02	-84.70	3	15
11312	60101017	13406	-8.03	-84.75	3	171
11313	60101018	08761HO	-8.03	-84.75	4	18
11314	60101020	13406	-8.15	-84.95	3	203
11315	60101022	13406	-8.30	-85.18	3	22
11316	60101023	13406	-8.43	-85.40	3	233
11317	60101101	13406	-8.58	-85.63	3	1
11318	60101102	13406	-8.72	-85.88	3	23
11384	60101814	13406	-10.53	-78.87	3	14
11385	60101814	08761HO	-10.53	-78.87	4	144
11412	60101807	13406	-10.97	-79.67	3	7
11413	60101808	13406	-10.87	-79.48	3	81
11414	60101808	08761HO	-10.87	-79.48	4	84
11415	60101811	13406	-10.80	-79.35	3	11
11416	60101812	13406	-10.72	-79.18	3	12
11417	60101813	13406	-10.62	-79.02	3	13
11433	60100317	03922	-11.88	-77.50	3	17
11434	60102620	13406	-11.95	-77.73	3	20
11469	60100400	03922	-11.20	-78.47	3	0
11470	60100411	03922	-11.48	-78.17	3	114
11471	60100412	03925	-11.58	-78.03	3	12
11496	60101806	13406	-11.07	-79.83	3	6
11500	60101714	13406	-11.68	-80.92	3	14
11501	60101715	13406	-11.60	-80.77	3	15
11502	60101716	13406	-11.50	-80.62	3	16
11503	60101716	13406	-11.45	-80.53	3	163
11504	60101717	08761HO	-11.45	-80.53	4	17
11505	60101719	13406	-11.37	-80.38	3	193
11506	60101720	13406	-11.28	-80.25	3	203
11507	60101721	13406	-11.20	-80.08	3	213
11508	60101722	13406	-11.17	-80.02	3	22
11509	60101722	08761HO	-11.17	-80.02	4	224
11511	60101708	13406	-11.95	-81.37	3	8
11512	60101709	13406	-11.85	-81.20	3	9
11513	60101709	08761HO	-11.85	-81.20	4	94
11514	60101713	13406	-11.78	-81.08	3	13

11522	60100114	03924	-12.13	-77.40	3	14
11523	60100616	03922	-12.40	-77.15	3	16
11524	60102621	13406	-12.07	-77.67	3	21
11525	60102622	13406	-12.20	-77.60	3	22
11526	60102623	13406	-12.33	-77.52	3	23
11527	60102700	13406	-12.47	-77.43	3	0
11528	60102701	13406	-12.60	-77.35	3	1
11529	60102702	13406	-12.73	-77.28	3	2
11530	60102703	13406	-12.85	-77.20	3	3
11531	60102704	13406	-12.98	-77.13	3	4
11584	60101704	13406	-12.35	-81.97	3	4
11585	60101705	13406	-12.23	-81.83	3	5
11586	60101706	13406	-12.15	-81.67	3	6
11589	60101707	13406	-12.07	-81.52	3	7
11591	60101619	13406	-12.82	-82.78	3	193
11592	60101621	13406	-12.60	-82.55	3	21
11593	60101622	13406	-12.53	-82.32	3	223
11594	60101623	13406	-12.42	-82.13	3	235
11595	60101700	08761HO	-12.42	-82.13	4	03
11596	60101618	13406	-12.95	-83.00	3	18
11598	60100620	03922	-13.60	-76.92	3	20
11599	60100701	03922	-13.72	-76.63	3	1
11600	60102706	13406	-13.25	-76.98	3	6
11601	60102707	13406	-13.38	-76.92	3	7
11602	60102708	13406	-13.52	-76.85	3	8
11603	60102709	13406	-13.63	-76.77	3	9
11604	60102710	13406	-13.75	-76.70	3	10
11605	60102720	13406	-13.78	-76.68	3	201
11606	60102812	13406	-13.73	-76.70	3	123
11607	60102814	13406	-13.90	-76.62	3	14
11632	60102705	13406	-13.12	-77.07	3	5
11659	60101606	13406	-13.33	-83.80	3	6
11660	60101611	13406	-13.18	-83.53	3	113
11661	60101613	08761HO	-13.18	-83.53	4	132
11662	60101615	13406	-13.13	-83.40	3	15
11663	60101600	13406	-13.88	-84.70	3	0
11664	60101601	13406	-13.75	-84.53	3	13
11665	60101603	13406	-13.62	-84.30	3	3
11666	60101604	13406	-13.48	-84.08	3	43
11667	60102815	13406	-14.05	-76.55	3	15
11668	60102816	13406	-14.22	-76.47	3	16
11669	60102817	13406	-14.38	-76.38	3	17
11670	60102818	13406	-14.53	-76.30	3	181
11671	60102819	13406	-14.68	-76.23	3	191
11672	60102820	13406	-14.85	-76.15	3	20
11673	60102823	08761HO	-14.85	-76.15	4	231
11674	60102902	13406	-14.97	-76.33	3	2
11707	60101514	13406	-14.53	-85.95	3	143
11708	60101516	13406	-14.42	-85.70	3	16
11709	60101517	13406	-14.27	-85.47	3	173
11710	60101519	13406	-14.13	-85.22	3	19
11711	60101520	13406	-14.05	-85.03	3	20
11712	60101521	08761HO	-14.05	-85.05	4	213
11730	60100704	03922	-15.70	-76.38	3	4
11731	60100704	03922	-15.70	-76.38	3	4
11732	60102903	13406	-15.08	-76.50	3	3
11733	60102904	13406	-15.18	-76.67	3	4
11734	60102906	13406	-15.22	-76.72	3	64
11735	60102907	08761HO	-15.22	-76.72	4	71
11736	60102910	13406	-15.32	-76.85	3	10
11754	60102911	13406	-15.45	-77.05	3	11
11755	60102912	13406	-15.57	-77.20	3	12
11756	60102913	13406	-15.67	-77.33	3	13
11757	60102913	08761HO	-15.67	-77.33	4	134
11758	60102919	13406	-15.75	-77.52	3	193
11759	60102920	13406	-15.85	-77.68	3	203
11760	60102921	13406	-15.93	-77.85	3	214

11761	60102922	08761HO	-15.93	-77.85	4	224
11822	60103001	13406	-16.05	-78.02	3	13
11823	60103002	13406	-16.15	-78.15	3	23
11824	60103003	13406	-16.23	-78.28	3	33
11825	60103004	13406	-16.33	-78.43	3	43
11826	60103005	13406	-16.43	-78.57	3	53
11827	60103006	13406	-16.45	-78.63	3	6
11828	60103007	08761HO	-16.45	-78.63	4	74
11829	60103012	13406	-16.57	-78.73	3	123
11830	60103013	13406	-16.68	-78.87	3	133
11832	60103014	13406	-16.80	-79.00	3	143
11833	60103015	13406	-16.92	-79.12	3	153
11866	60100712	03922	-17.90	-74.83	3	12
11876	60100712	03924	-17.65	-75.85	3	12
11883	60100712	03925	-17.60	-76.08	3	12
11890	60103016	13406	-17.05	-79.25	3	163
11891	60103017	13406	-17.18	-79.45	3	173
11892	60103018	08761HO	-17.18	-79.45	4	18
11893	60103021	13406	-17.30	-79.62	3	21
11894	60103022	13406	-17.43	-79.83	3	223
11895	60103100	13406	-17.55	-80.08	3	0
11896	60103101	13406	-17.70	-80.30	3	13
11897	60103103	13406	-17.85	-80.53	3	3
11917	60100716	03922	-18.93	-74.58	3	16
11926	60103104	13406	-18.00	-80.77	3	43
11927	60103107	13406	-18.10	-80.93	3	72
11928	60103108	08761HO	-18.10	-80.93	4	8
11929	60103114	13406	-18.28	-81.17	3	14
11930	60103115	13406	-18.48	-81.45	3	153
11931	60103117	13406	-18.68	-81.72	3	17
11932	60103118	13406	-18.80	-81.90	3	183
11933	60103120	13406	-18.92	-82.10	3	20
11943	60103121	13406	-19.07	-82.30	3	213
11944	60103122	08761HO	-19.07	-82.30	4	22
11962	60111612	03869	-2.22	-81.43	3	12
11963	60112415	06751RH	-2.98	-81.48	4	15
11964	60112415	03869	-2.92	-81.45	3	152
11965	60112416	03869	-2.48	-81.48	3	16
11966	60112417	03869	-2.23	-81.50	3	17
11967	60112418	03869	-2.05	-81.52	3	18
12113	60112412	03869	-3.60	-81.48	3	12
12114	60112413	03869	-3.35	-81.48	3	13
12115	60112414	03869	-3.17	-81.48	3	14
12116	60112414	03869	-3.00	-81.48	3	144
12207	60112406	03869	-4.87	-81.48	3	6
12208	60112407	03869	-4.60	-81.48	3	7
12209	60112408	03869	-4.43	-81.47	3	8
12210	60112409	03869	-4.25	-81.45	3	9
12211	60112409	03869	-4.10	-81.45	3	94
12212	60112410	06751RH	-4.07	-81.45	4	10
12213	60112410	03869	-4.00	-81.48	3	102
12312	60112402	03869	-5.88	-81.32	3	2
12313	60112403	03869	-5.68	-81.35	3	3
12314	60112404	03869	-5.37	-81.42	3	4
12315	60112405	03869	-5.10	-81.45	3	5
12414	60112320	03869	-6.97	-80.97	3	20
12444	60112321	03869	-6.78	-81.08	3	21
12445	60112322	03869	-6.58	-81.22	3	22
12446	60112323	03869	-6.38	-81.28	3	23
12447	60112400	03869	-6.18	-81.30	3	0
12448	60112400	03869	-6.12	-81.28	3	05
12449	60112401	06751RH	-6.02	-81.28	4	1
12450	60112401	03869	-6.00	-81.30	3	13
12593	60112315	03869	-7.90	-80.48	3	154
12594	60112316	06751RH	-7.97	-80.43	4	16
12595	60112317	03869	-7.67	-80.60	3	17
12596	60112318	03869	-7.42	-80.77	3	18

12597	60112319	03869	-7.20	-80.85	3	19
12794	60112311	03869	-8.77	-80.12	3	11
12795	60112312	03869	-8.57	-80.18	3	12
12796	60112313	03869	-8.33	-80.25	3	13
12797	60112314	C3869	-8.15	-80.37	3	14
12798	60112315	03869	-8.03	-80.42	3	15
12930	60112305	03869	-9.83	-79.73	3	5
12931	60112306	03869	-9.60	-79.88	3	6
12932	60112307	03869	-9.40	-79.97	3	7
12933	60112309	06751RH	-9.17	-79.98	4	9
13002	60112308	03869	-9.18	-80.27	3	8
13003	60112308	03869	-9.03	-80.18	3	85
13004	60112309	03869	-9.07	-80.05	3	94
13057	60112223	03869	-10.87	-78.85	3	23
13058	60112300	03869	-10.78	-78.98	3	0
13138	60112301	03869	-10.63	-79.30	3	1
13139	60112302	03869	-10.42	-79.42	3	2
13140	60112303	03869	-10.25	-79.52	3	3
13141	60112304	03869	-10.02	-79.63	3	4
13242	60112220	03869	-11.37	-78.20	3	20
13243	60112221	03869	-11.30	-78.40	3	21
13244	60112222	03869	-11.10	-78.58	3	22
13998	60110701	13406	-17.63	-72.97	3	13
13999	60110702	13406	-17.57	-72.87	3	21
14000	60110702	08761HO	-17.57	-72.87	4	24
14001	60110709	13406	-17.20	-72.32	3	94
14002	60110710	08761HO	-17.20	-72.32	4	102
14003	60111005	13406	-17.13	-72.22	3	53
14004	60111007	13406	-17.38	-72.17	3	7
14005	60111008	13406	-17.63	-72.10	3	83
14006	60111010	13406	-17.90	-72.05	3	10
14031	60110600	08761HO	-17.98	-73.37	4	0
14034	60110615	13406	-17.95	-73.68	3	153
14035	60110616	13406	-17.85	-73.57	3	163
14036	60110617	13406	-17.98	-73.37	3	175
14037	60110623	13406	-17.85	-73.18	3	233
14038	60110700	13406	-17.75	-73.03	3	03
14111	60110613	13406	-18.20	-73.98	3	133
14112	60110614	13406	-18.08	-73.82	3	143
14124	60110601	13406	-18.97	-74.80	3	11
14125	60110601	08761HO	-18.97	-74.80	4	15
14126	60110607	13406	-18.73	-74.55	3	7
14127	60110608	13406	-18.62	-74.42	3	8
14128	60110609	13406	-18.48	-74.27	3	9
14130	60110610	13406	-18.37	-74.15	3	10
14131	60110610	13406	-18.30	-74.05	3	104
14132	60110611	08761HO	-18.30	-74.05	4	112
14155	60110600	13406	-19.10	-74.93	3	0
14158	60110516	13406	-19.82	-75.78	3	16
14159	60110517	13406	-19.65	-75.55	3	173
14160	60110518	13406	-19.60	-75.50	3	18
14161	60110518	08761HO	-19.60	-75.50	4	183
14162	60110521	13406	-19.48	-75.38	3	21
14163	60110522	13406	-19.35	-75.25	3	22
14164	60110523	13406	-19.22	-75.10	3	23
14173	60110101	13406	-19.20	-82.48	3	1
14176	60110102	13406	-19.35	-82.70	3	23
14177	60110104	13406	-19.50	-82.90	3	4
14178	60110105	13406	-19.67	-83.13	3	53
14179	60110107	13406	-19.83	-83.35	3	7
14180	60110108	13406	-19.98	-83.55	3	83
14181	60110514	13406	-20.00	-76.02	3	143

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MES DE JUNIO

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NRO	GR.FECHA	COD.BUQ	LAT	LON	T	HO
6570	61060717	00011BO	-12.05	-77.33	4	17
6571	61060717	14514	-12.05	-77.33	3	17
6572	61060719	00011BO	-12.05	-77.50	4	19
6573	61060719	14514	-12.05	-77.50	3	19
6574	61060720	14514	-12.05	-77.67	3	20
6575	61060721	00011BO	-12.05	-77.67	4	21
6576	61060723	14514	-12.05	-77.83	3	23
6577	61060823	00011BO	-12.05	-77.83	4	23
6619	61060802	14514	-12.05	-78.00	3	2
6620	61060803	00011BO	-12.05	-78.17	4	3
6621	61060803	14514	-12.05	-78.17	3	3
6622	61060805	14514	-12.05	-78.33	3	5
6623	61060807	00011BO	-12.05	-78.50	4	7
6624	61060807	14514	-12.05	-78.50	3	7
6199	66060813	00041HU	-2.00	-80.83	4	13
6204	66060815	00041HU	-2.00	-81.00	4	15
6205	66060815	00041HU	-2.00	-81.00	4	15
6206	66060816	00041HU	-2.00	-81.17	4	16
6207	66060818	00041HU	-2.00	-81.33	4	18
6208	66060820	14807	-2.00	-81.00	3	20
6209	66060821	14807	-2.00	-81.17	3	21
6210	66060822	00041HU	-2.00	-81.67	4	22
6211	66060900	14807	-2.00	-81.33	3	0
6212	66060903	14807	-2.00	-81.67	3	3
6240	66060901	00041HU	-2.00	-82.03	4	1
6241	66060905	14807	-2.00	-82.03	3	5
6242	66060906	00041HU	-2.00	-82.57	4	6
6243	66060911	14807	-2.00	-82.57	3	11
6256	66060916	00041HU	-2.00	-83.63	4	16
6257	66060916	14807	-2.00	-83.10	3	16
6258	66060921	14807	-2.00	-83.63	3	21
6259	66060923	00041HU	-2.00	-83.10	4	23
6283	66060100	10731AO	-3.52	-81.17	4	0
6369	66060806	21508	-7.98	-79.72	3	6
6375	66060705	21508	-7.40	-80.55	3	5
6425	66061105	21508	-9.52	-78.77	3	5
6541	66061308	21508	-11.92	-78.68	3	8
6542	66061315	21508	-11.88	-78.08	3	15
6543	66061405	21508	-11.88	-78.32	3	5
6559	66061202	21508	-11.80	-79.72	3	2
6560	66061207	21508	-11.60	-79.93	3	7
6561	66061215	21508	-11.87	-79.73	3	15
6562	66061217	10731AO	-11.87	-79.73	4	17
6563	66061223	21508	-11.93	-79.10	3	23
6603	66062415	21508	-12.05	-77.30	3	15
6604	66062416	10741AO	-12.05	-77.30	4	16
6605	66062423	21508	-12.30	-77.48	3	23
6606	66062500	10741AO	-12.30	-77.48	4	0
6607	66062513	21508	-12.48	-77.45	3	13
6610	66062514	10741AO	-12.48	-77.45	4	14
6611	66062601	21508	-12.72	-77.45	3	1
6612	66062602	10741AO	-12.72	-77.45	4	2
6668	66062618	21508	-13.25	-77.47	3	18
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6724	69061020	15051	-15.63	-74.77	3	20
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6271	72062018	3101WT	-2.10	-84.35	10	18
6272	72062019	3101WT	-2.10	-84.38	10	19
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6453	74060618	00721SN	-9.53	-79.87	4	18
6454	74060622	00721SN	-9.15	-79.33	4	22
6460	74060613	00721SN	-9.92	-80.38	4	13
6493	74060600	00721SN	-10.13	-78.23	4	0
6556	74060518	00721SN	-11.08	-78.75	4	18
6617	74060420	00721SN	-12.07	-77.27	4	20
6618	74060500	00721SN	-12.03	-77.77	4	0
6643	74060504	00721SN	-12.03	-78.28	4	4
6644	74060508	00721SN	-12.05	-78.78	4	8
6650	74060512	00721SN	-12.07	-79.28	4	12
6327	75060200	R160	-5.77	-85.93	5	0
6363	75062906	32U4TM	-6.83	-85.90	10	6
6390	75060112	R160	-7.13	-84.12	5	12
6412	75060100	R160	-8.53	-82.33	5	0
6414	75062918	32U4TM	-8.67	-83.37	10	18
6499	75063006	32U4TM	-10.68	-81.00	10	6

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